2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-4)
Wildfire and PSPS

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the Wildfire and Public Safety Power Shutoff (PSPS) Risk. This chapter contains information and analysis for this risk that meets the requirements of the California Public Utilities Commission's (CPUC or Commission) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (the Phase 2 Decision) and D.24-05-064 (the Phase 3 Decision). The Wildfire and PSPS Risk is included in this 2025 RAMP report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance.

This risk chapter describes the basis for selection of the Wildfire and PSPS Risk, controls and/or mitigations to reduce the likelihood and consequence of utility related wildfires and mitigate the impacts of PSPS de-energization events in SDG&E's service territory, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities but does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation, consistent with the method and process prescribed in the RDF.

In accordance with California Public Utilities (Pub. Util.) Code Section (§) 8386(a), SDG&E constructs, maintains, and operates its electric system in a manner that minimizes the risk of catastrophic wildfire posed by its electric power lines and equipment. Additionally, pursuant to Pub. Util. § 8386(b), SDG&E prepares and submits a Base Wildfire Mitigation Plan (WMP) every three years detailing its preventive strategies and programs, and updates those plans annually. Building on over 15 years of wildfire prevention and mitigation work, SDG&E's 2026-2028 Base WMP[2] continues to focus on reducing wildfire risk and reducing the impact of

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1 As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

2 SDG&E's 2026-2028 Wildfire Mitigation Plan (May 2, 2025) (2026-2028 Base WMP), available at https://www.sdge.com/2026-2028-wildfire-mitigation-plan.

PSPS de-energizations on customers.

The risk discussion and quantification presented in this chapter incorporates risk modeling requirements from the Phase 2 and Phase 3 Decisions and the 2026-2028 Wildfire Mitigation Plan Technical Guidelines, as well as additional requirements established by the Office of Energy Infrastructure Safety (Energy Safety) in approving SDG&E's annual WMPs and updates. These include calculating risk scores using maximum consequence values, incorporating extreme weather scenarios into planning models, and implementing third-party recommendations for model improvements. SDG&E's risk framework is used to obtain segment risk ranking, segment CBR analysis, and portfolio analysis. It is used to support investment decisions, including grid hardening initiatives in the High Fire Threat District (HFTD).

In addition to optimizing risk reduction, SDG&E works to align with RAMP and WMP guidelines when developing its long-term wildfire mitigation strategy.[3] To further promote cost-efficient and risk informed investment, SDG&E has enhanced its wildfire risk model, WiNGS-Planning, by incorporating risk-quantification requirements that yield a comprehensive and optimized strategy aligned with the above guidelines. The supporting workpapers for this chapter are also consistent with SDG&E's resulting long-term strategy to mitigate Wildfire and PSPS Risk.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's Wildfire Risk is defined as the risk of catastrophic wildfire, initiated by SDG&E equipment, whether through normal operation or failure, that may pose an immediate threat to the communities, the environment, and overall safety resulting in fatalities, widespread property destruction, and a multi-billion-dollar liability. SDG&E defines the PSPS Risk as the risk created from proactive de-energization of infrastructure during extreme fire weather conditions, which can result in negative impacts on customers and communities.

The California Legislature has found that "[t]he increased risk of catastrophic wildfires poses an immediate threat to communities and properties throughout the state,"[4] and "[t]he state

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[3] SDG&E is exploring whether to develop an Electrical Undergrounding Plan (EUP) pursuant to Pub. Util. Code section 8388.5 and thus must also include consideration of the EUP guidelines.

[4] Assembly Bill (AB) 1054 (2019-2020), Section 1(a)(1).

has dramatically increased investment in wildfire prevention and response, which must be matched by increased efforts of the electrical corporations."[5] SDG&E's wildfire mitigation efforts are consistent with the mandates of Pub. Util. Code Section 8386, Senate Bill (SB) 901, and AB 1054.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as General Order (GO) 95, GO 165, FAC-501-WECC, Pub. Util. Code § 451, FAC-003-4, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection act. A list of compliance requirements applicable to Wildfire and PSPS Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations, enhancing SDG&E's community relationships and partnerships, and preparing for future capacity needs (such as driven by electrification or climate impacts).

2. Risk Overview

SDG&E's service territory is frequently impacted by Santa Ana winds, which have been directly linked to the most significant and devastating wildfires in Southern California, including the recent Los Angeles wildfires in January 2025. These strong offshore winds bring in extremely low humidity and anomalously high temperatures, leading to critically low moisture levels in dry vegetation fuels (such as grasses, shrubs, and trees) and creating highly flammable conditions that significantly increase the risk of catastrophic wildfires. The increased wildfire risk during these extreme fire weather conditions can result in frequent PSPS de-energization events, which are implemented to prevent utility-related ignitions.

In January 2025, SDG&E's service territory experienced multiple waves of extreme Santa Ana winds over a three-week period, with wind gusts exceeding 100 miles per hour, critically low humidity levels, and unprecedented lack of rain in the Southern California region. San Diego County experienced the driest start to the rainy season in the 174 years records have been kept. In response to these threatening wildfire-weather conditions, SDG&E activated its Emergency Operations Center, where it utilized 223 of the nation's most sophisticated weather monitoring stations to continuously track wind speeds and fire weather conditions, helping to make informed and targeted decisions about communities at risk. Wind speeds in the county

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5 AB 1054, Section 2(a).

reached record highs, with 62 of SDG&E's weather monitoring stations exceeding wind-gust records across the territory. PSPS de-energizations were implemented as a crucial last resort wildfire prevention measure in response to unprecedented weather conditions that led to prolonged high-fire risk. These measures were essential for safeguarding lives, property, and entire communities during times of extreme fire risk.

B. Risk Scope

In D.17-12-024,[6] the Commission established the HFTD, defining areas that have a greater potential for wildfires. The HFTD consists of Tier 2 areas, "where there is an elevated risk for destructive utility-associated wildfires," and Tier 3 areas, "where there is an extreme risk for destructive utility-associated wildfires."[7] Approximately 64% of the service territory is in the HFTD. As described in this chapter, the majority of SDG&E's wildfire mitigation initiatives are aimed at risk reduction in the HFTD, however, SDG&E employs some risk mitigation efforts across the service territory, such as vegetation management, and certain mitigations are implemented in a risk-informed manner in non-HFTD areas, such as the Wildland Urban Interface (WUI).

The scope of this chapter includes wildfires that meet the CPUC Fire Incident Data Collection requirements for reporting. In accordance with D.14-02-015,[8] a wildfire must be reported if all three of the following criteria are met:

- A self-propagating fire of material other than electrical and/or communication facilities;
- The resulting fire traveled greater than one linear meter from the ignition point; and
- The utility has knowledge that the fire occurred.

The impacts of PSPS de-energizations to customers during extreme fire weather conditions, and de-energizations caused by Protective Equipment Device Settings (PEDS) are also included in the scope of the overall risk assessment.

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[6] D.17-12-024 at 2-3.

[7] D.17-12-024 at 2.

[8] D.14-02-015, Appendix C at C-3.

C. Data Sources Used in Quantifying Risk Estimates[9]

SDG&E utilized internal data sources to determine a Wildfire and PSPS Risk Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post-Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the Wildfire and PSPS Risk, including SDG&E's risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

Wildfire and PSPS were identified as a risk in SDG&E's 2021 RAMP and included in the Enterprise Risk Registry (ERR)[10] for 2022, 2023, and 2024. SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3: Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[11] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The Wildfire and PSPS Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a Pre-Filing Workshop. The Wildfire and PSPS Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to the inclusion of this risk in SDG&E's 2025 RAMP Report.

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9 Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

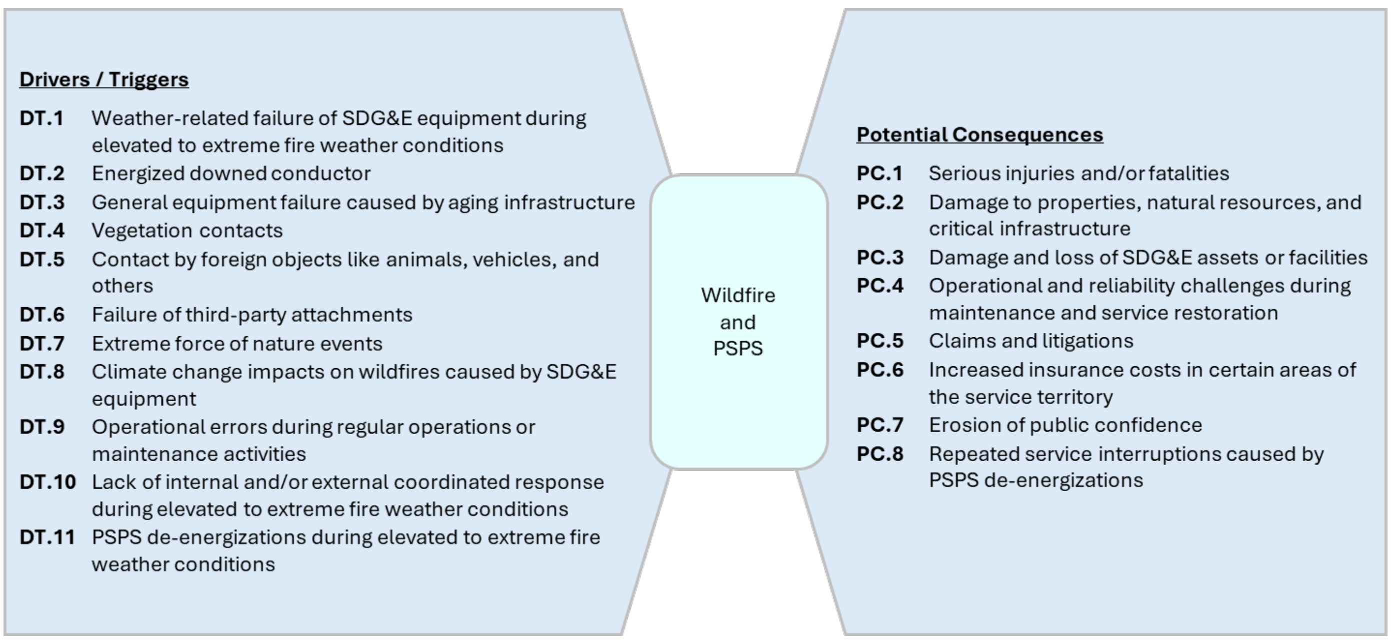
10 In the 2021 RAMP Report this risk was called Wildfire Involving SDG&E Equipment. The risk definition and elements are unchanged.

11 D.24-05-064, RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[12] As illustrated in the risk Bow Tie shown in Figure 1, the Risk Event (center of the Bow Tie) is a wildfire involving SDG&E equipment that could lead to fatalities, widespread property destruction, and a multi-billion-dollar liability. Additionally, repeated service interruptions caused by PSPS or PEDS de-energization events during fire-weather conditions can result in significant disruption, economic losses, and adverse impacts on community well-being. The left side of the Bow Tie illustrates Drivers/Triggers, and the right side shows the Potential Consequences. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the addressed elements of the risk Bow Tie is provided in Attachment C.

Figure 1: Wildfire and PSPS: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[13]

When performing a risk assessment for the Wildfire and PSPS Risk, SDG&E identifies potential leading indicators, referred to as Drivers or Triggers, that reflect expected and/or

[12] D.24-05-064, RDF Row 15.

[13] Potential risk event Drivers/Triggers refer to an indication that a risk could occur. They may not reflect actual conditions.

forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[14] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1: Weather-related failure of SDG&E equipment during elevated to extreme fire weather conditions**: Weather plays a large part in the potential failure of SDG&E equipment. Excessive wind, lightning, and exposure to weather over time can degrade the integrity of the electrical components and lead to failure of one or more of the electrical parts, causing a failure of the conductor.
- **DT.2: Energized downed conductor**: A downed conductor (or “wire down”) occurs when a conductor drops or breaks from its designed location on a pole and cross arm and ends up on the ground, sometimes in energized mode. A wire down can result from a variety of factors, many of which are outside of SDG&E’s control.
- **DT.3: General equipment failure caused by aging infrastructure**: General equipment failure, due to age, can be a source of ignition. Failure of components such as connectors, hot line clamps, and insulators can result in wire failure and end up in a wire down situation, sometimes in energized mode. Other equipment failures can also spark ignitions regardless of whether they lead to wire-down situations.
- **DT.4: Vegetation contact**: During storms and severe wind events, branches are shed by trees in the vicinity of SDG&E facilities. These can fall on conductors, leading to conductor failure or, in the case of palm fronds or other small branches, phase-to-phase contact and a cascade of sparks. In addition, trees that are many feet away from an energized conductor can uproot and fall on the conductor, causing pole and equipment damage, line failure, or sparking.
- **DT.5: Contact by foreign objects like animals, vehicles and other foreign objects**: Foreign objects coming into contact with SDG&E’s facilities can also present sources of ignition. For example, Mylar balloons are highly conductive and can cause phase-to-phase faulting on contact, which can cause the conductor

[14] D.24-05-064, RDF Row 10-11.

to fail and land in energized mode, causing arcing and sparking in dry conditions. In addition, vehicular contact can bring down conductors and sometimes the entire pole, resulting in conductors laying on the ground in an energized mode.

- **DT.6: Failure of third-party attachments:** As mandated by the CPUC, SDG&E must allow communication infrastructure providers to attach to utility poles when space is available. These providers might not properly install or inspect their equipment, which can lead to third-party attachment contact with the electrical facilities, leading to fire-related incidents.
- **DT.7: Extreme force of nature events**: SDG&E's overhead electrical facilities are fully exposed to the elements. Significant weather and wind-related events can cause a variety of problems related to equipment failure and downed conductors. Also, continual exposure to natural elements can degrade or weaken key components, which may not be found until the following scheduled inspection and repair cycle.
- **DT.8: Climate change impacts on wildfires caused by SDG&E equipment:** Despite SDG&E's proactive approach to mitigating wildfire risk, expected increases in temperature in the decades to come will likely lead to high-risk fire areas expanding from the foothills and mountains into the lower elevation coastal canyons and wildland urban interfaces. Prolonged periods of drought increase the risk of wildfires occurring, potentially extending the focus of SDG&E's threat monitoring and response efforts. This could lead to more frequent PSPS de-energizations, shifting from primarily dry fall months to more of a year-round concern. The greatest threat would be when conditions are typically driest and most conducive to wildfire outbreaks. These changes in climate trends have already been realized across the region, culminating in a previously unseen wildfire outbreak across coastal San Diego County in May of 2014. Based on the most recent climate change projections, as discussed in the latest Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), these trends are likely to continue and worsen into the future.[15]

[15] IPCC, Sixth Assessment Report (March 2023), available at https://www.ipcc.ch/assessment-report/ar6/.

- **DT.9: Operational errors during regular operations or maintenance activities**: Operational errors during operations and maintenance activities can lead to switching errors that can cause outages or equipment damage; failing to perform regular inspections or incorrect installation can lead to equipment failure and damage; and non-compliance with standards and insufficient training for personnel can lead to errors in operations and maintenance activities.
- **DT.10: Lack of internal or external coordinated response during elevated to extreme fire weather conditions**: A well-coordinated response to electric utility incidents, such as downed conductors, is crucial for ensuring safety and minimizing damage. Effective coordination can facilitate the suppression of fires and the safe de-energization of electrical equipment, thereby reducing the risk of electrical exposure to first responders and the public. Additionally, it can help prevent the escalation of incidents, leading to more efficient and timely resolutions. Lack of coordination could lead to uncontrolled fires during extreme wind conditions, increasing the risk of widespread damage and posing significant threats to public safety.
- **DT.11: PSPS de-energization during elevated to extreme fire weather conditions:** Operational wildfire risk mitigations such as PSPS de-energizations are implemented during elevated to extreme fire weather conditions. While PSPS de-energizations and other operational mitigations have proven effective, as evidenced by the fact that no significant wildfires have been caused by SDG&E's system since 2007, the inherent wildfire risk remains in the grid and PSPS de-energizations continue to impact SDG&E communities.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie provided in Figure 1. SDG&E identifies the Potential Consequences of Wildfire and PSPS Risk by analyzing internal data sources, where available, industry data, and subject matter expertise.[16] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers/Triggers listed above were to result in an incident, the Potential Consequences, in a

[16] D.24-05-064, RDF Row 10.

plausible worst-case scenario, could include:

- **PC.1:** Serious injuries and/or fatalities
- **PC.2:** Damage to properties, natural resources, and critical infrastructure
- **PC.3:** Damage and loss of SDG&E assets or facilities
- **PC.4:** Operational and reliability challenges during maintenance and service restoration
- **PC.5:** Claims and litigations
- **PC.6:** Increased insurance costs in certain areas of the service territory
- **PC.7:** Erosion of public confidence
- **PC.8:** Repeated service interruptions caused by PSPS de-energizations

SDG&E used these Potential Consequences to score the Wildfire and PSPS Risk in developing its 2024 ERR.

E. Evolution of Risk Drivers and Consequences

As specified in the Phase 3 Decision,[17] the following changes to the previous ERR and/or the 2021 RAMP include:

- Inclusion of the PSPS Risk: Risk created from proactively shutting off power to SDG&E customers during extreme fire weather conditions.
- One additional driver/trigger (DT) as well as two potential consequences (PCs) were added to the bow tie depicted in Figure 1 that were not listed in the 2021 RAMP bow tie as follows:

1. Changes to Drivers/Triggers of the Risk Bow Tie

- Added DT.11: PSPS de-energizations during elevated to extreme fire weather conditions

2. Changes to Potential Consequences of the Risk Bow Tie

- Added PC.6: Increased insurance costs in certain areas of the service territory
- Added PC.8: Repeated service interruptions caused by PSPS de-energizations

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching

[17] D.24-05-064, RDF Row 8.

Methodology (HTM) as outlined in Chapter RAMP-3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Wildfire and PSPS
Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches HTM
Non-HFTD	3,913 (feeder - segments)	20
HFTD (Tier-2)	472 (feeder-segments)	22
HFTD (Tier-3)	308 (feeder-segments)	22

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, Table 2 provides the pre-mitigation risk values for the Wildfire and PSPS Risk. Further details, including pre-mitigation risk values by tranche, are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3: Risk Quantification Framework.

Table 2: Wildfire and PSPS
Monetized Risk Values
(Direct, in 2024 $ millions)

Risk Aversion	LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
		Safety	Reliability	Financial		
Scaled Risk Values	127.02	$1.60	$1.08	$21.10	$23.78	$ 3,020.61
Unscaled Risk Values	127.02	$0.47	$1.04	$2.24	$3.75	$ 476.42

A. Risk Value Methodology

SDG&E's risk modeling for the Wildfire and PSPS Risk follows RDF guidance[18] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** Wildfire and PSPS Risk is quantified in a combined attribute hierarchy as shown in Table 2, such that Safety, Reliability, and Financial are presented based on available, observable and measurable data.
2. **Cost Benefit Approach Principle 2-Measured Observations (RDF Row 3):** Wildfire and PSPS Risk used observable and measurable data in the estimation of CoRE values. SDG&E utilized actual location and number of electrical outages to estimate the likelihood of a wildfire risk event and Technosylva's wildfire modeling software FireSight™[19]to estimate potential ignition size (acres burned) and impact (buildings destroyed) both at and around asset locations within the service territory. This model incorporates historical weather variables, detailed fuel layers, and a 24-hour unsuppressed fire spread model. For PSPS and PEDS, SDG&E utilizes historical customer counts and outage duration records.[20]
3. **Cost Benefit Approach Principle 3-Comparison (RDF Row 4):** Wildfire and PSPS Risk utilized proxy data as provided by various sources including, but not

[18] D.24-05-064, RDF Rows 2-7.

[19] Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

[20] *See* Chapter RAMP-3: Risk Quantification Framework and Appendix B: Wildfire and PSPS - Reference Material for Quantitative Analyses.

limited to, the Federal per diem[21] rates applicable to San Diego, CA to estimate the potential financial loss experienced by customers affected by a PSPS de-energization event.

4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** SDG&E's Wildfire Consequence model employs a Generalized Pareto Distribution (GPD, a type of Power Law distribution), with a maximum value (truncated), to inform the expected values and tail values of simulated wildfire economic losses. Additionally, SDG&E uses Monte Carlo simulations to estimate the likelihood and Consequences of Wildfire Risk events across every feeder segment within its service territory. This comprehensive approach accurately represents both common and extreme wildfire events and enhances the precision of risk assessments to inform effective mitigation strategies.[22]

5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $4.1 million per serious injury, and $49 thousand for minor injury;[23] the Electric Reliability CoRE attribute is valued at a monetized equivalent of $3.76 per CMI; and the Financial CoRE attribute is valued at $1 per dollar.[24]

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

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21 FederalPay.org, San Diego, California Per Diem Rates for FY 2024, available at https://www.federalpay.org/perdiem/2024/california/san-diego .

22 *See* Section III.B, *infra*.

23 *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

24 *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

6. Cost Benefit Approach Principle 6-Adjusted Attribute Level (Row 7):

Table 3: Wildfire and PSPS
Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

Risk Aversion	Safety	Reliability	Financial	Total
Scaled Risk Values	$ 1.60	$ 1.08	$ 21.10	$ 23.78
Unscaled Risk Values	$ 0.47	$ 1.04	$ 2.24	$ 3.75

The values in Table 3 above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3: Risk Quantification Framework to the CoRE attributes for the Wildfire and PSPS Risk. Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3: Risk Quantification Framework.

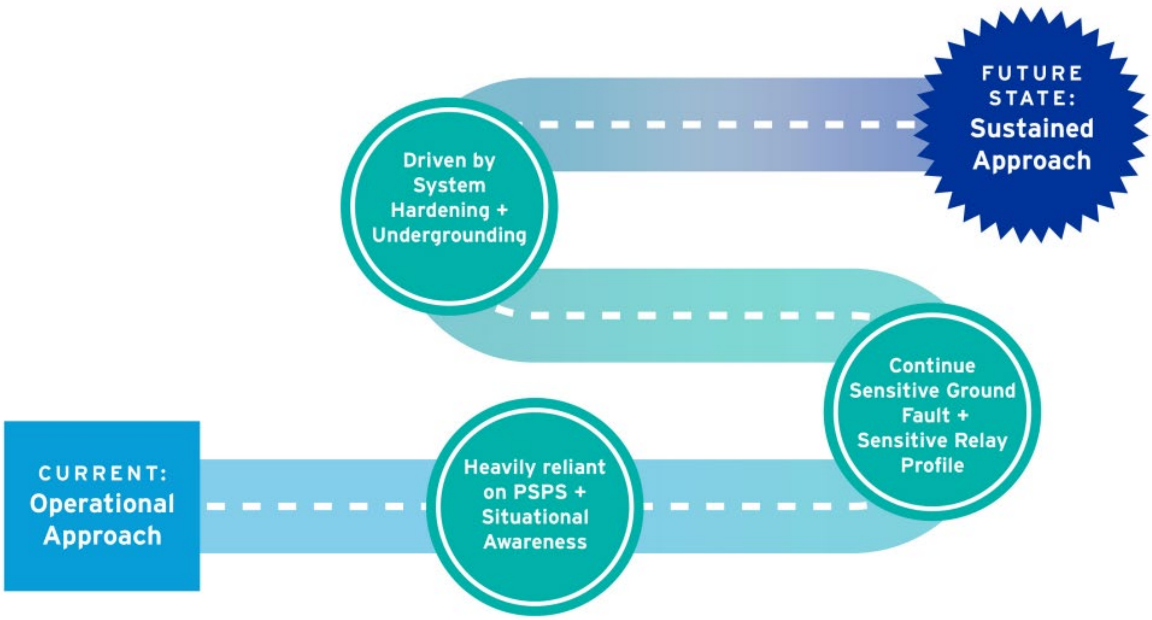
B. Wildfire, PSPS and PEDS Risk Methodology

To enhance system resilience, reduce wildfire risks, and minimize customer disruptions during extreme fire weather conditions, SDG&E developed a comprehensive strategy to identify and mitigate ignition risks. Using a data-driven, risk-based approach, SDG&E identifies, quantifies, and implements tailored mitigation strategies for each location within its service territory, with additional focus on the HFTD. This includes the implementation of systemic risk reduction measures, such as deploying covered conductor and strategic undergrounding, to enhance system resilience, as well as operational risk reduction measures such as inspections, vegetation management, and emergency operations. Additionally, SDG&E performs proactive PSPS during extreme fire weather conditions to further safeguard communities.

SDG&E's long-term wildfire mitigation strategy seeks to transform from an operations-dependent approach of managing Wildfire and PSPS Risk into a sustained approach of targeted, risk-based, and sustained systemic Wildfire and PSPS Risk reduction efforts. The operational approach includes mitigations such as PSPS de-energizations, asset inspections, vegetation management, and other interim grid hardening programs that enable grid monitoring and well-informed situational awareness. A sustained systemic approach includes risk-informed grid hardening programs, such as Strategic Undergrounding and Combined Covered Conductor, that provide a higher level of sustained wildfire risk reduction by mitigating against primary risk

Drivers and reducing the scale, scope, and frequency of PSPS de-energizations without introducing other reliability risks.

Figure 2: Long-Term Risk Reduction Approach



SDG&E continues to enhance its analytics capabilities and improve its risk models to better inform both operational and long-term grid-hardening investment decisions. In alignment with the methodologies and quantifications presented in the 2026-2028 Base WMP,[25] SDG&E's risk assessments adhere to the RDF Framework and Energy Safety's latest modeling requirements, and intervenor and stakeholder feedback is captured where reasonable and possible. Additionally, SDG&E's risk modeling framework provides consistent, transparent, and auditable results to support effective decision-making and strategic planning for wildfire and PSPS risk mitigation. At a high level, SDG&E has expanded its WiNGS-Planning model to accommodate the Cost-Benefit Framework required for the 2025 RAMP filing. This transformation enables a probabilistic framework that quantifies Wildfire, PSPS, and PEDS Risk, as defined below, at the conductor-span level, capturing segment-specific criteria such as weather conditions, customer demographics, asset attributes, and event-specific assumptions.

[25] 2026-2028 Base WMP.

Wildfire Risk: The total annualized impacts from ignitions caused by SDG&E's electrical asset at a specific location for both the expected value (EV) and select percentiles (tail values).

PSPS Risk: The total annualized impacts from a PSPS de-energization at a specific location for both the expected value (EV) and select percentiles (tail values). PSPS Risk is significantly influenced by the topology of the circuit feeder segment and its association with weather stations. Additionally, the number and type of customers, enterprise assumptions, and de-energization-specific assumptions also play crucial roles in determining the risk.

PEDS Risk: The total annualized impacts from Protective Equipment and Device Settings (PEDS) at a specific location for both the EV and select percentiles (tail values). These settings are enabled to minimize or eliminate the chance of an ignition in the event of a fault on electric lines. SDG&E reviews and adjusts these settings annually to improve reliability where possible.

This framework allows SDG&E to evaluate pre-mitigated risk baselines, post-mitigated residual risk levels, cost effectiveness, and tail risk events, and incorporate societal risk aversion into its mitigation selection.

The ongoing risk modeling improvement plan includes an assessment of additional factors such as climate vulnerability and a more detailed analysis of risk Drivers. Furthermore, enhancements to modeling design and architecture are in progress to facilitate the tracking and validation of various model risk components, establish a formalized process for independent reviews, and expand the use of models to inform the selection and prioritization of mitigation initiatives beyond the installation of combined covered conductor and the undergrounding of electric lines.

1. WiNGS-Planning Model

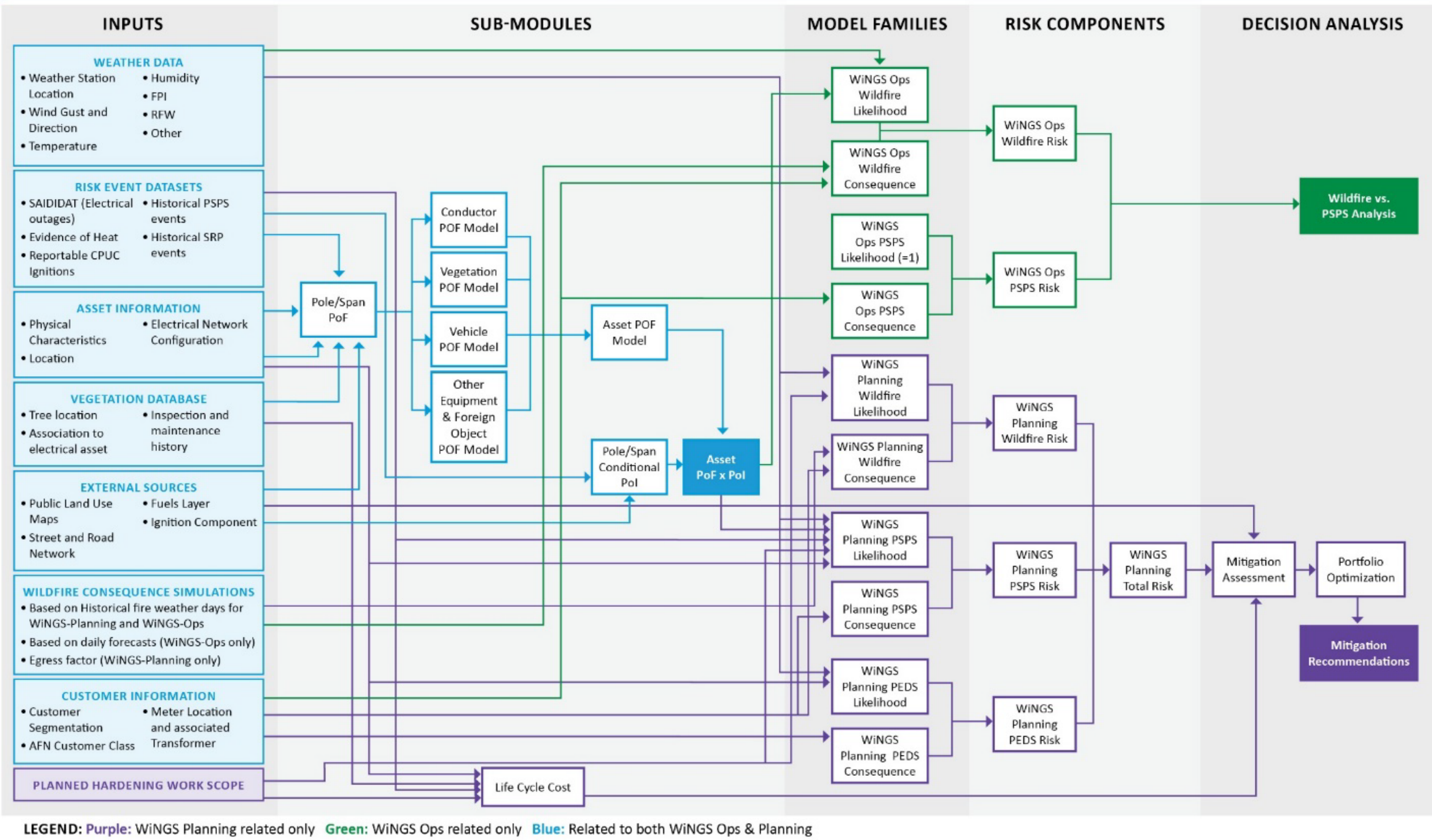
The WiNGS-Planning model calculates Wildfire, PSPS, and PEDS Risks that are incorporated into the overall wildfire and outage program risk components. It was developed to assist in allocating grid hardening initiatives—namely Covered Conductor and Strategic Undergrounding—across the HFTD by evaluating the expected risk and cost of available measures. The primary objective of the WiNGS-Planning model is to identify durable, cost-effective mitigations that reduce wildfire risk and minimize the impacts of PSPS de-energizations and PEDS-driven outages for SDG&E's customers.

The WiNGS-Planning risk framework has been modified to align with the Cost-Benefit Framework developed for the 2025 RAMP filing.[26] It evaluates risk as a probability distribution of estimated costs at the conductor-span level, which is then aggregated to the feeder-segment level for decision optimization in grid-hardening mitigation selections. The model's output guides investment decisions by performing a cost-benefit analysis for strategic undergrounding and combined cover conductor mitigations.

The risk calculation process for the WiNGS-Planning models is described in Figure 3.

[26] D.22-12-027; D.24-05-064; 2026-2028 Base WMP.

Figure 3: WiNGS Planning Calculation Schematic



WiNGS-Planning utilizes statistical and machine learning models developed with historical electrical outage and ignition data and correlated with historical asset characteristics, vegetation, site-specific conditions, and weather conditions to capture the influence of wind gust and wind direction variables at the time of the outage or ignition. By analyzing these correlations and the influence of other variables, insights into the probability of failure and probability of ignition across various wind gust scenarios can be determined and combined with consequence quantifications to consider the potential impacts of an outage or ignition event. This comprehensive approach allows for an optimized assessment of risk by integrating both the probability of occurrence and the severity of consequences.

The model's risk event probability distributions, developed from a Monte Carlo-based framework, also allow for the simulation of various scenarios of grid hardening initiatives to assess the expected risk reduction at each feeder-segment within the service territory.

The models are trained on a decade of historical records and predict the probability of failure and ignition using 2 years of historical weather and fuels data from the weather station network. Failure and ignition rates are calculated at the pole and span level under diverse weather and fuel conditions, offering a comprehensive overview of potential outcomes. Model outputs are reviewed by risk data scientists, Fire Coordination, Meteorology, and Engineering experts in order to validate the models and identify future improvements.

Several models and sub-models provide insights into Wildfire and PSPS Risk during fire weather conditions to inform PSPS de-energization and long-term grid hardening decisions. These model families integrate numerous inputs across weather, asset, customer information, event-specific assumptions, and other external source data categories, as shown in Figure 3. Models include:

- Likelihood of Failure-and-Ignition Models: Estimate the likelihood of span- and pole-based ignitions based on fault drivers.
- Likelihood of a PSPS de-energization Models: Estimates the likelihood of a disrupted PSPS de-energization based on weather station historical wind gust frequency.
- Likelihood of a PEDS de-energization Model: Estimates the likelihood of an electrical outage caused by enabling PEDS.
- Wildfire Consequence Models: Utilizes simulations of potential wildfire impacts in the service territory based on historical fire weather and forecasted weather conditions.

- PSPS and PEDS Consequence Models: Utilize historical data, subject matter expert assumptions, and the Cost-Benefit Framework to assess the Potential Consequences of utility outages for each Supervisory Control and Data Acquisition (SCADA) sectionalizing device in the HFTD.

2. Data Sources

The WiNGS-Planning model utilizes a comprehensive array of data sources[27] to assess Wildfire, PSPS, and PEDS Risks effectively. It incorporates historical electrical outage and ignition data, including CPUC-reportable ignitions[28] and non-reportable ignitions. These two sets of data are collected from Fire Coordination and District Engineers and are used by subject matter experts to identify patterns and causes of electrical failures and fires. Detailed information about asset characteristics, such as conductor size, material, and type, is used alongside vegetation data to understand the influence of surrounding conditions on fire risk. Site-specific conditions, including historical weather data, such as wind gusts and directions, temperature, and humidity, are integrated to capture the environmental factors contributing to outages and ignitions. The Wildfire Consequence model leverages data from Technosylva,[29] which assesses and aggregates the potential impacts of wildfires at every pole location for circuit segments.

3. Risk Event Drivers

Wildfire Risk is highly situational and is influenced by numerous variables such as weather conditions, vegetation, situational awareness, and suppression resources. Further, the effect of these variables changes through the conditions of a wildfire. For example, suppression resources have no bearing on failure risk, and their effectiveness in the event of a failure-and-ignition is conditioned on factors such as ignition location, weather, and coincidence of other fires. As such, Wildfire Risk modeling must be much more dynamic than the risk modeling for SDG&E’s other RAMP risks. Many risk Drivers are also beyond SDG&E’s control, including man-made debris, animal contacts, vehicle incidents, and human activities.

While catastrophic wildfires are infrequent (low probability) events, their potential for significant community and environmental impact highlight the importance of comprehensive risk assessment. Advanced modeling techniques and diverse data sources are therefore utilized to

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27 *See* Attachment B, *infra*.

28 D.14-02-015.

29 Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

better estimate risk. SDG&E also collaborates with industry experts, academic institutions, and government agencies to continually refine these models. SDG&E has also transitioned risk assessments to a probabilistic framework that estimates the likelihood of the full range of potential risk consequences for each feeder segment. This transition involved enhancing SDG&E's risk assessment tools, improving modeling capabilities to address diverse risk scenarios, performing sensitivity analyses, and evaluating the impact of known extreme events. These improvements result in an optimized long-term strategy designed to enhance public safety and minimize customer disruption to customers during extreme fire weather conditions.

The shift to a probabilistic framework in SDG&E's WiNGS-Planning model aligns with the risk modeling requirements set forth by D.24-05-064,[30] the 2026-2028 Wildfire Mitigation Plan Technical Guidelines[31] and additional requirements established by Energy Safety when approving SDG&E's WMPs.[32] [33]

4. Risk Assessment – Wildfire, PSPS & PEDS

SDG&E's risk assessment framework is built around Wildfire, PSPS, and PEDS Risk models, which are integrated into a comprehensive Monte Carlo simulation covering five million simulated years for every asset. This large-scale simulation produces asset-level risk events, which represent the likelihoods for Wildfire, PSPS and PEDS Risks. The following discussion outlines the key probabilistic factors that influence these likelihoods.

For wildfires, the model leverages ignition probabilities, calculated at the asset level, that are calibrated to match observed annual ignition rates from historical records. When an ignition is simulated, it is assigned a random date drawn from a normal distribution spanning eight years of meteorological data. This date determines the specific weather and fuel conditions for the event, which may result in no consequence or, if conditions align, a consequence derived from Technosylva's fire spread simulations for that location and date's weather conditions.

The PSPS model uses 10 years of meteorological data to determine how often wind

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30 D.24-05-064 at 29-33.

31 SDG&E's 2026-2028 Wildfire Mitigation Plan Technical Guidelines, available at https://energysafety.ca.gov/what-we-do/electrical-infrastructure-safety/wildfire-mitigation-and-safety/wildfire-mitigation-plans/2026-28-wildfire-mitigation-plan-guidelines/.

32 SDG&E's 2023-2025 WMP (March 27, 2023) available at https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=56955&shareable=true

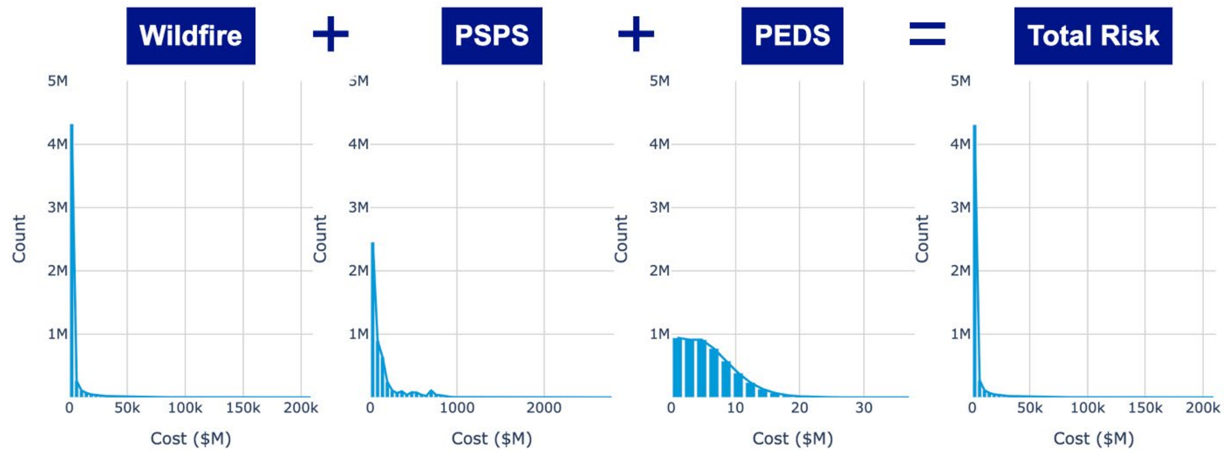
33 *See* 2026-2028 Base WMP at Appendix D: Areas for Continued Improvement.

speeds at each asset's associated weather station exceeded operational alert thresholds. It also accounts for network connectivity. If an upstream asset is unhardened, the risk of de-energization is increased for all downstream assets, whether or not they are hardened. To simulate how PSPS de-energizations unfold, a random value is drawn for each of the high fire days in a simulated year, representing the region-wide wind conditions for that day. All assets whose weather stations exceed their alert thresholds on that day are considered candidates for a PSPS de-energization, mirroring how an Emergency Operations Center (EOC) activation would be triggered during a real de-energization. In line with operational protocols, the model then randomly selects segments representing a number of customers that would be affected by the PSPS de-energization, and these segments are assigned a PSPS cost for that activation. This approach reflects both the physical interconnections of the grid and the practical realities of PSPS operations are reflected in the probability and impact estimates.

The PEDS model uses historical outage data to calculate two statistical distributions: one for the annual frequency of PEDS de-energization and another for the consequence of each event, measured in customer minutes interrupted. For each simulated event, the model samples from the frequency distribution to determine how many PEDS outages would occur and then samples from the consequence distribution to estimate the impact of each event. Because the specific factors that make an asset more likely to cause a PEDS outage are not well understood, these events are assigned randomly to assets throughout the simulation.

Running simulations over a five-million-year time horizon (*e.g.*, five million one-year simulations) was necessary to capture rare-but-consequential events and approach stability in risk estimates. Earlier efforts using 100,000 and 1 million simulated years resulted in material volatility in risk estimates—especially for assets that contained feeder-segments with low likelihoods. By scaling to five million simulated years per asset, the model sufficiently captures infrequent outcomes and supports more stable and representative average annualized risk estimates. However, this scale introduces substantial computational and data management challenges, requiring both high-performance hardware and optimizations in how results are processed, stored, and aggregated while retaining resolution down to the individual asset level. As data availability, modeling best practices, and computational tools continue to advance, SDG&E will be able to further refine these simulations and improve efficiency so that risk estimates remain robust, actionable, and aligned with regulatory expectations.

Figure 4: HFTD Risk Including Risk Aversion Attitude



Once LoRE and CoRE are calculated, Wildfire Risk can be calculated for Wildfire Risk, PSPS Risk, and PEDS Risk:

The Wildfire Risk score is the product of wildfire LoRE and wildfire CoRE

$$WF\ Risk\ =\ WF\ LoRE\ \times\ WF\ CoRE$$

The PSPS Risk score is the product of PSPS LoRE and PSPS CoRE

$$PSPS\ Risk\ =\ PSPS\ LoRE\ \times\ PSPS\ CoRE$$

The PEDS Risk score is the product of PEDS LoRE and PEDS CoRE

$$Overall\ Risk\ =\ WF\ Risk +\ PSPS\ Risk + PEDS\ Risk$$

The Overall Wildfire, PSPS, PEDS Risk is the summation of WF Risk, PSPS Risk, and PEDS Risk.

5. Likelihood of a Risk Event

The LoRE component of WiNGS-Planning leverages a variety of data sources[34] to calculate the likelihood (depicted as a probability distribution) of a risk event occurring in a year. Table 4 summarizes the underlaying statistical, machine learning, and deterministic models utilized in WiNGS-Planning.

34 *See* Attachment B, *infra*.

Table 4: Likelihood of Risk Event Models

Model Name/ Risk Component	Model Description
Conductor Probability of Failure	This model is a statistical model (log-log regression) that estimates the likelihood and frequency of a conductor failure (*i.e.*, wire down) at every span in the service territory. This model incorporates historical weather conditions, with an emphasis on wind gusts, and correlates these conditions with site-specific factors and asset attributes. This model is designed to support scenario analysis in WiNGS-Planning by predicting historical conductor outages through the input of past weather conditions (backcasting).
Vegetation Probability of Failure	This model is a statistical model (log-log regression) that estimates the likelihood and frequency of a vegetation failure (*i.e.,* tree strike causing a wire down) at every span in the service territory. This model incorporates historical weather conditions, with an emphasis on wind gusts, and correlates these conditions with site-specific factors, asset attributes, and tree inventory data. This model is designed to support scenario analysis in WiNGS-Planning by predicting historical vegetation outages through the input of past weather conditions (backcasting).
Vehicle Contact Probability of Failure	This model is a machine Learning model (XGBoost) that estimates the likelihood of a vehicle contact at the asset location.
Other Equipment & Foreign Object PoF	This is a deterministic model that is used to account for the number of historical outages that do not show a correlation with wind gust conditions or exhibit significant seasonality. This model captures outages resulting from equipment failures that are not related to wind events, such as fuse damages, recloser malfunctions, and transformer issues. It also accounts for outages caused by external forces, including animal interference, balloons, and contact by employees or members of the public. The model also includes random outages due to vandalism, theft, and other unforeseen incidents.
Pole/Span Conditional Probability of Ignition	This model is the annual ignition rate in the HFTD adjusted to account for wind speed, historical tree strikes, vegetation density, asset hardening, and asset health.
Wildfire Likelihood	This model simulates the annual frequency of ignition event occurrences leading to potential wildfires by leveraging probabilistic Probability of Ignition (PoI) values and simulated wind speeds. It is used to help estimate the impact of wildfire risk with the integration with the Wildfire Consequence model.
PSPS Likelihood	This model estimates the probability that a given feeder-segment would be proactively de-energized due to PSPS on a given high-fire day by leveraging historical wind speeds measured at all upstream weather

Model Name/ Risk Component	Model Description
	stations and taking into account the grid-hardening state of the full upstream trace from the given feeder-segment. It also forecasts the number of PSPS de-energizations and leverages the PSPS Consequence attributes to estimate the magnitude of forecasted PSPS de-energizations, including the number of customers de-energized per event.
PEDS Likelihood	This model simulates the annual frequency of PEDS outage impact occurrences in a specific location of the grid.

6. Consequence of a Risk Event

The CoRE is calculated in accordance with the Cost Benefit Framework. Given the occurrence of a risk event (Wildfire, PSPS, or PEDS), this framework is used to estimate the Potential Consequences across the three main attributes (Safety, Reliability, and Financial) to determine a total Consequence value in dollars.

Wildfire Consequence estimations are derived from Technosylva's FireSight™ simulations (also known as WFA-E WRRM). These simulations assess fire behavior at each asset location under historical worst-case fire weather conditions, which is used to devise site-specific mitigation strategies, ensuring that each asset and community is protected based on its unique risk profile and environmental conditions.

In recent years, SDG&E has explored various methods to accurately and comprehensively assess the potential impacts of catastrophic wildfires within its service territory down to the asset-span level. Understanding the potential wildfire consequences under different weather conditions at such a detailed level improves risk assessment, resulting in the development of more effective long-term mitigation strategies, and more informed operational decisions during extreme fire weather conditions.

SDG&E uses a truncated power law distribution model that characterizes wildfire economic losses within its service territory to better understand, predict, and mitigate the impacts of catastrophic wildfires.[35] This methodology is consistent with power law distributions that effectively capture the probability of high-consequence "tail" losses, which are the extreme consequences that occur at the right end of the probability distribution. It is important to include

35 *See* D.24-05-064 at 54 ("the utility should use a truncated power law distribution to model tail value in wildfire risks, which we consider to be a best practice."); *see also* Findings of Fact 18 and 19.

these rare but highly destructive events in the model in order to determine the most effective long-term investment strategies and operational decisions during extreme fire weather conditions.

SDG&E conducted a comprehensive statistical analysis of historical wildfire records from 2000 to 2023 to assess the financial consequences of wildfire events. Through this analysis, SDG&E determined that a GPD,[36] a type of power law distribution, effectively models the potential economic losses caused by wildfires within its service territory. This study built upon previous research performed by SDG&E that compared the effectiveness of the GPD to the previously utilized Gamma distribution.[37]

SDG&E will review and, if necessary, update its current GPD model using data from the most recent wildfires in Southern California.

Table 5: Return Periods and Expected Financial Losses

#	Return Period [Year]	Probability [%]	Prob. Exceedance [%]	Expected Financial Loss [$B]
0	2	50.00%	50.00%	$ 0.72
1	5	80.00%	20.00%	$ 1.42
2	10	90.00%	10.00%	$ 2.11
3	20	95.00%	5.00%	$ 2.97
4	50	98.00%	2.00%	$ 4.45
5	100	99.00%	1.00%	$ 5.88
6	200	99.50%	0.50%	$ 7.67
7	250	99.60%	0.40%	$ 8.34
8	500	99.80%	0.20%	$ 10.74
9	1000	99.90%	0.10%	$ 13.73
10	max	100.00%	0.00%	$ 25.00

SDG&E's current GPD model indicates an annual average loss (or expected loss per year) of $1.087 billion. A maximum economic loss cap of $25 billion is imposed, which

36 The following parameters describe the GPD distribution, in millions of dollars, if SciPy Python package is used: Shape parameter (c): 0.31859, loc: 305.34614, and scale: 532.3386, available at https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.genpareto.html.

37 A.22-05-015/016, 2024 GRC, Second Revised Prepared Direct Testimony of Gregory S. Flores and R. Scott Pearson (Chapter 2: RAMP to GRC Integration) (June 2023) (Ex. SCG-03-2R-E/SDG&E-03-2R-E) at 9, Appendix B at B-2, B-5, B-10, B-11, and B-16.

represents a realistic estimate of average losses based on historical events and subject matter expertise.

Relying solely on historical estimates to develop mitigation strategies assumes that the worst-case scenario has already occurred within SDG&E's service territory. This approach can be problematic when developing and justifying a long-term hardening strategy, especially one with an assumed lifetime of approximately five decades. A single event like the Witch Fire of 2007, while devastating, may not adequately represent future risks and evolving conditions. Relying on one worst-case instance of wildfire activity to define the existing wildfire risk could underestimate potential future threats. Therefore, a broader range of data must be incorporated, including predictive modeling and climate projections, to result in a comprehensive and resilient wildfire mitigation strategy.

Relying solely on historical data recorded in SDG&E's service territory to develop robust long-term mitigation strategies also introduces bias due to proactive de-energizations (PSPS) that have occurred since 2013. Sole reliance on historical data may also result in wildfire consequence estimates failing to capture the full spectrum of potential outcomes. This limitation is particularly pronounced in regions experiencing extreme fire weather conditions, where evolving environmental factors and escalating wildfire activity could lead to unforeseen scenarios.

To address this known limitation, SDG&E enhanced its Wildfire Consequence model in 2024 by incorporating Technosylva's FireSight™ [38] unsuppressed fire simulations with a 24-hour duration. These simulations are performed at each asset location and consider historical worst-case fire-weather scenarios. By analyzing these conditions, SDG&E estimates the potential size (acres burned) and impact (buildings destroyed) of possible ignitions at each asset. This approach captures detailed site-specific conditions such as wind gusts and directions, fuel layer conditions, and topographical features, providing a comprehensive assessment of wildfire risks.

The transition from an 8-hour to a 24-hour simulation duration is justified by the alignment observed between the GPD model and Technosylva's 24-hour monetized consequence estimates. This alignment is particularly notable for events with return periods below 100 years. Extending the simulation duration to 24 hours allows for a more comprehensive analysis of

[38] Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

wildfire behavior and impacts, capturing the full progression of fire events over a longer timeframe. This shift not only aligns with SDG&E's GPD, but it also enhances the precision of risk modeling, enabling better-informed decision-making for mitigation strategies and resource allocation.

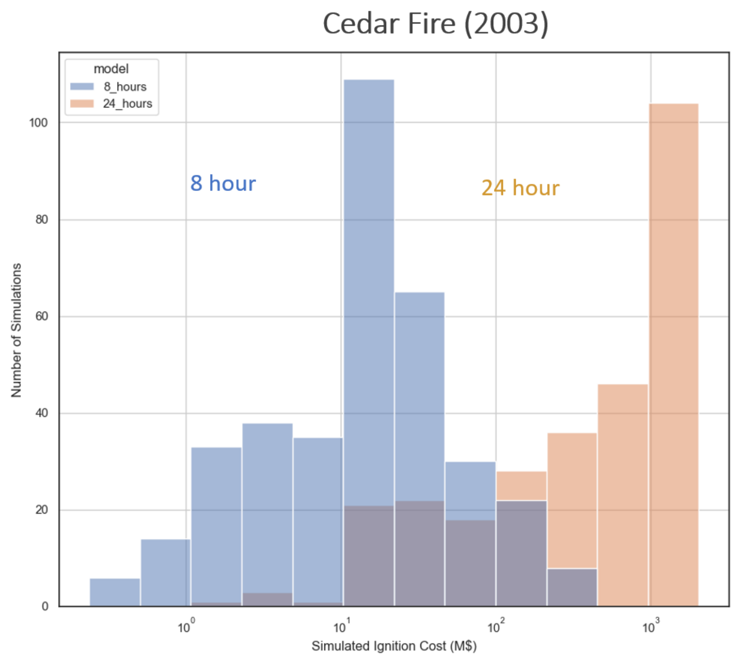
Table 6: Return Periods and Expected Financial Losses: Comparison of SDG&E's GPD and Technosylva 24-Hour Simulations

#	Return Period [Year]	Probability [%]	Prob. Exceedance [%]	GPD Expected Financial Loss [$B]	Technosylva 24-hour Expected Financial Loss [$B]
1	20	95.00%	5.00%	$ 2.97	$ 2.51
2	50	98.00%	2.00%	$ 4.45	$ 3.64
3	100	99.00%	1.00%	$ 5.88	$ 4.37
4	200	99.50%	0.50%	$ 7.67	$ 4.99
5	250	99.60%	0.40%	$ 8.34	$ 5.18
6	500	99.80%	0.20%	$ 10.74	$ 5.66
7	1000	99.90%	0.10%	$ 13.73	$ 6.12
8	max	100.00%	0.00%	$ 25.00	$ 10.27
10	AAL	---	---	$ 1.0875	$ 0.6526

SDG&E also compared the monetized values of both Technosylva simulations—8-hour and 24-hour durations—against the two largest wildfires recorded in its service territory under fire-weather conditions: the Cedar Fire (2003) and the Witch Fire (2007). To conduct this analysis, origins of simulated fires were selected from assets located near the starting points of these historical fires and under worst-case fire-weather scenarios. This comparison provided valuable insights into the limitations of the 8-hour simulations, as well as the potential financial impacts and return intervals of similar catastrophic events in both locations.

Figure 5 provides a detailed analysis of the Cedar Fire and Witch Fire, illustrating a histogram with frequency counts (y-axis) of financial impacts on a logarithmic scale (x-axis) for 8-hour and 24-hour Technosylva simulations. This histogram offers a precise visualization of the distribution of simulated financial impacts across varying weather scenarios and simulation durations. Additionally, Figure 5 includes a summary table that presents expected return values at multiple percentiles, specifically focusing on 1-in-10 to 1-in-100-year values. This table delivers a comprehensive analysis of the potential financial consequences of wildfire events in both locations. Furthermore, Figure 5 references two publicly available sources that provide financial estimates of these significant wildfire events, facilitating a comparison between simulated consequence values and actual historical data. This combined dataset underscores the limitations inherent in the 8-hour simulations and highlights the necessity of incorporating longer-duration simulations for accurate risk assessment and strategic long-term mitigation planning.

Figure 5: Cedar Fire and Witch Fire vs. Technosylva Simulations: Return Intervals and Financial Impacts

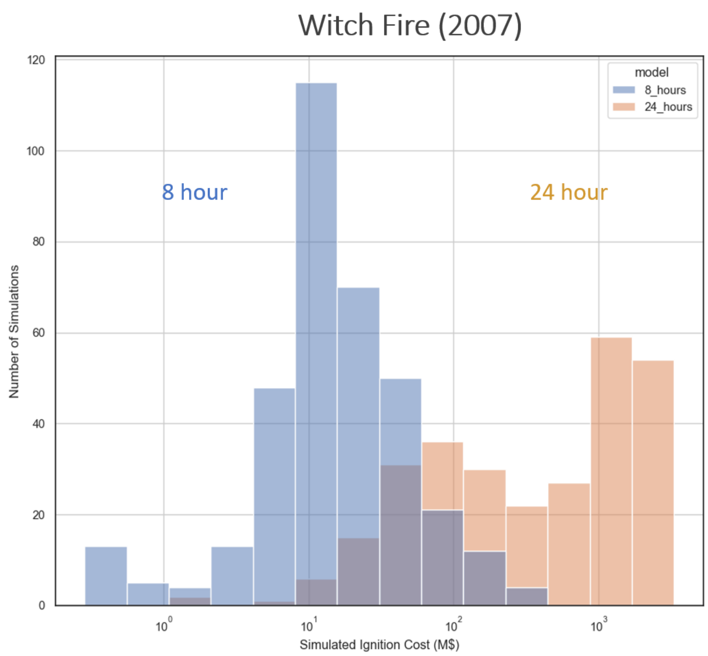


Percentile	Technosylva 8 hour	Technosylva 24 hour
P50	$32	$506
P90	$75	$1,723
P95	$141	$1,785
P98	$224	$1875
P99	$297	$1,990
AAL	$32	$726

Publicly available cost (M$) estimates:

- 2003: $1,331M [1]
- 2025: ~$2,291M

[1] https://en.wikipedia.org/wiki/Cedar_Fire



Percentile	Technosylva 8 hour	Technosylva 24 hour
P50	$14	$399
P90	$61	$2,461
P95	$105	$2,876
P98	$163	$3,087
P99	$220	$3,162
AAL	$28	$857

Publicly available cost (M$) estimates:

- 2007: $1,339M [2]
- 2024: ~$2,031M [2]
- 2025: ~$2,088M

[2] https://en.wikipedia.org/wiki/Witch_Fire

SDG&E is currently collaborating with Technosylva to conduct a sensitivity analysis aimed at evaluating the impact of changing the start and end times of the simulations. Currently, SDG&E uses a midnight-to-midnight simulation period, but to better align with historical peak wind gusts observed during extreme fire weather conditions, SDG&E is evaluating a 6pm-to-6pm simulation period.

Fire weather scenarios used to estimate potential wildfire impacts are evaluated for a selection of 125 days spanning from 2013 to 2021 that represent the worst fire weather days in SDG&E's service territory. The selection of fire weather days is based on the following criteria:

- Historical Data Analysis: Subject matter experts analyze historical weather data from 2013 to 2021 to identify days with extreme fire weather conditions.[39]
- Weather Conditions: Particular attention is given to days with high wind gusts, wind direction, temperature, and humidity levels that contribute to fire risk.
- Asset and Site-Specific Conditions: The conditions of electrical assets and specific site characteristics are considered to understand their vulnerability during extreme weather events.
- FPI: Weather indices such as the FPI are used to quantify and compare fire risk levels on different days.

[39] SDG&E is evaluating the inclusion of days in November 2024 and January 2025 that experienced extreme fire weather conditions.

Technosylva's wildfire modeling incorporates weather variables, detailed fuel layers, and a 24-hour unsuppressed fire spread model to estimate potential ignition size (acres burned) and impact (buildings destroyed) both at and around asset locations within the service territory.

- Safety Attribute: Assumptions for Serious Injuries and Fatalities (SIF) estimates are based on a review of historical wildfire data and are updated when new data is available. To estimate the total number of equivalent fatalities per structure destroyed a 0.00617 factor is assumed. This factor is estimated based on an internal analysis conducted on the CALFIRE dataset. SIFs estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Reliability Attribute: Assumptions for Customer Minutes Interrupted (CMI) estimates are derived from a review of historical outage data and are updated as new data becomes available. A 24-hour restoration time is assumed. CMI estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Financial Attribute: This attribute is calculated from historical wildfire records (acres burned and structures destroyed). Due to the difficulty of determining the precise financial losses of wildfire events and the lack of a single source of financial impacts from wildfire, subject matter expert assumptions are made when translating acres burned and buildings destroyed into a financial dollar estimate. Wildfire events primarily have costs related to property damage, personal injury or fatality, suppression costs, environmental damage and remediation, lost economic output (including work closures and employee unavailability), and personal relocation.
    - Suppression and restoration cost: $2,350/acres burned[40]
    - Structure destroyed cost: $1,000,000/structure destroyed[41]

Available data is used to approximate financial impacts, and assumptions will continue to be modified as new information becomes available. In addition, partnerships with industry leader companies and academic institutions will continue to better estimate the financial impact of a catastrophic wildfire in SDG&E's communities.

7. Extreme Events and Climate

SDG&E is currently evaluating various approaches to model future wildfire risk, with a

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[40] Subject matter expert assumption based on a review of CALFIRE suppression costs incurred from 2000 to 2023. Data for 2024 and 2025, which would include the recent fires in Los Angeles, is not included as suppression costs for these incidents were not available as of February 2025.

[41] Subject matter expert assumption based on a review of publicly available data on the median listing home price in San Diego County as of February 2025.

focus on the projected potential increase in acres burned compared to historical records. By identifying this increase, SDG&E can efficiently update its WiNGS-Planning modeling framework and estimate future wildfire risk scenarios. To project future acres burned, SDG&E is evaluating and testing the model developed by the U.S. Forest Service, as discussed in Prestemon et al. (2022),[42] which predicts monthly area burned in acres for each US Forest Service Region using pseudo-Poisson maximum likelihood models.[43] Forest Service Region 5 comprises federal lands in California, Hawaii, and the U.S. Affiliated Pacific Islands,[44] but Prestemon et al. (2022) specify that the area burned models are for regions of the continental United States (CONUS).[45] Thus, the following area burned model from Prestemon et al. (2022) can be applied to federal lands in California:[46]

$$\text{Acres } burned = e^{708-123 lnT_{max}+8.4 lnVPD}$$

where *Acres burned* is the monthly area burned in acres, T_{max} is the monthly average of the daily maximum temperature in degrees Kelvin, VPD is the monthly average of the daily average vapor pressure deficit (VPD), and the coefficients are those evaluated by Prestemon et al. (2022) for Forest Service Region 5.[47]

VPD is a measure of how much moisture the air contains relative to the maximum amount of moisture it could hold and is a function of temperature and relative humidity.[48] The coefficients for this parametric model were estimated using 324 observations of monthly area

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42 Prestemon, J.P., Erin Belval, Sara Brown, Jennifer Costanza, Linda Joyce, Shannon Kay, Mark Lichtenstein, Jeffrey Morisette, Karin Riley, Karen Short. U.S. Department of Agriculture Forest Service. 2022. Technical Appendix: Climate Risk Exposure: Federal Wildfire and Suppression Expenditures. Research and Development, USDA Forest Service. In: White House Office of Management and Budget, Climate Risk Exposure: An Assessment of the Federal Government's Financial Risks to Climate Change (Prestemon et al. (2022)) at 66-118, available at https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/04/OMB_Climate_Risk_Exposure_2022.pdf .

43 *Id*., Technical Appendix at 74.

44 USDA, Forest Service, U.S. Department of Agriculture, *About the Area (Region 5, Pacific Southwest Region)* (Accessed April 1, 2025), available at https://www.fs.usda.gov/main/r5/about-region.

45 Prestemon et al. (2022) at 66-118 and 70.

46 *Id.,* Technical Appendix at 74.

47 Prestemon et al. (2022), Technical Appendix, Table B-1, at 93-94.

48 *Id*., Technical Appendix at 73.

burned and climate data from 2006 to 2018.[49]

Prestemon et al. (2022) used historical climate data and projections from the U.S. Forest Service's 2020 Resources Planning Act Assessment (RPA) climate projections supplemented by additional data from RPA parent datasets.[50] The RPA climate projections are a subset of the MACAv2METDATA set, which is downscaled from the Coupled Model Inter-Comparison Project 5 (CMIP5).[51] Prestemon et al. (2022) state: "The RPA data set contains the historical data (METDATA, 1979-2015), and the historical modeled data (1950-2005) and the future projections (2006-2099) (MACAv2-METDATA) for 5 climate models under two Representative Concentration Pathway scenarios (RCP 4.5 and 8.5) (Table B1)."[52] While Prestemon et al. (2022) used RCPs to develop their model, SDG&E intends to use the Shared Socioeconomic Pathways (SSP) models for its study and for future implementation.

Because Prestemon et al. (2022) area burned model was developed for federal lands in California, rather than for SDG&E's service territory, the prediction of changes in area burned in SDG&E's service territory requires additional consideration and research. This is not a limitation of the model in and of itself, but rather a caveat regarding its suitability for this site-specific application. Prestemon et al. (2022) do note several assumptions and limitations in their models of area burned, stating, "Modeling area burned requires some strong assumptions, that, in the face of a changing climate, could be difficult to justify."[53] Summarily, these limitations and assumptions arise as part of the defined model scope set by Prestemon et al. (2022) and the modeling limitations encountered. For detailed discussion on these items, see the pertinent sections at pages 82-87 of Prestemon et al. (2022). A selection of the authors' acknowledgments includes, but is not limited to, the following:

- "We expect climate change to alter forest and range ecosystem compositions, and vegetation changes will, in turn, alter how many acres burn and how often and intensely they burn. In this analysis, because hazardous fuels are not directly

[49] *Id.*, Technical Appendix, Table B-1, at 93-94.

[50] *Id.,* Technical Appendix at 75-76.

[51] *Id.,* Technical Appendix at 75.

[52] *Id.*

[53] *Id.*, Technical Appendix at 74.

modeled, our models carry an assumption that these vegetation changes will not matter to… area burned…"[54]

- "Our models make long-run projections, without evaluating which factors that are typically assumed fixed might be variable in the long-run, such as fire regimes, biomes, and suppression strategies."[55]
- "Our statistical models of area burned and expenditures are parsimonious, with area burned specified as a function of monthly maximum daily temperature and/or vapor pressure deficit. There is little doubt that potentially influential variables are omitted in our chosen specifications."[56]

Given the known limitations and complexity of accurately incorporating climate change projections into its cost-benefit analysis, SDG&E recognizes the need for further research on and development of the Prestemon et al. (2022) methodology and other relevant approaches, such as the wildfire projections produced by the University of California Merced research team that informed California's Fourth Climate Change Assessment (Westerling (2018)).[57] As discussed in Westerling (2018), these projections developed statistical (*e.g.*, logistic regression, Poisson lognormal, and generalized Pareto distributions) models for large wildfire presence, number, and size under a wide range of future climate change scenarios while also accounting for population and development footprint scenarios. The most recent wildfire projection dataset that is currently available at Cal-Adapt[58] is still based on the outdated CMIP5-based work by Westerling (2018). Efforts are currently underway by the UC Merced research team to update wildfire projections using the latest CMIP6 simulation results, which will be used for the upcoming Fifth Climate Change Assessment (2026).

Consequently, all wildfire risk estimates presented in SDG&E's Wildfire and PSPS workpapers do not account for long-term impacts driven by climate change. This approach keeps estimates grounded in the most current and actionable data available while acknowledging the

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54 *Id.*

55 *Id.,* Technical Appendix at 86.

56 *Id.,* Technical Appendix at 83.

57 Westerling, Anthony Leroy. (University of California, Merced). 2018. *Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate*, available at https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-014_ADA.pdf.

58 Cal-adapt, *Explore and analyze climate data from California's Climate Change Assessments*, available at https://cal-adapt.org/.

ongoing efforts to enhance the models with future climate projections.

In the coming months and years, SDG&E plans to investigate the incorporation of climate change factors into its wildfire risk event simulations. This integration is expected to result in potentially higher estimates of acres burned and structures destroyed than those currently used, which will impact the financial attribute of the consequences of a risk event. By accounting for climate change, SDG&E aims to enhance the accuracy and predictive power of its risk models, improving the evaluation of projected scenarios and informing more effective long-term grid-hardening strategies.

In conjunction with climate change, the population is expected to grow more quickly in the HFTDs compared to other areas,[59] with new building construction following a similar trend. Therefore, SDG&E is evaluating the incorporation of population change forecasts into its wildfire risk models. To account for population change, SDG&E intends to develop a scale factor based on forecasted population changes within the HFTD, which will be calculated as the forecasted HFTD population each year divided by the HFTD population in a baseline year. A similar scale factor will be developed for structures destroyed in a wildfire, which will use forecasts of relative changes to housing unit counts as a proxy for the number structures in the HFTD. Additional consideration will be given for buildings subject to wildland-urban interface ignition-resistant construction requirements, which typically apply in designated Fire Hazard Severity Zones; the developed approach will only consider new construction outside of these zones.

In addition, SDG&E does not currently analyze extreme events or highly uncertain scenarios. Instead, the WiNGS-Planning model is designed to incorporate historical weather conditions experienced within the service territory. The model can simulate a variety of weather conditions based on past data, providing a robust framework for risk analysis based on known conditions. By focusing on historical weather patterns, the model can accurately reflect the range of conditions that have been observed over time, allowing for more reliable predictions and effective planning.

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59 SANDAG Open Data Portal, *San Diego Association of Governments, Series 15 Forecasts Housing Units by 2020 Census Tract* (August 16, 2024) available at https://opendata.sandag.org/Forecast/Series-15-Forecasts-Housing-Units-by-2020-Census-T/k2nk-z5si/about_data.

To model longer-term scenarios with higher uncertainty requires an assessment of the entire service territory beyond the current focus on overhead lines in the HFTD. Furthermore, evaluating extremely low-probability events, including those unrelated to wildfire risk and outside the HFTD, offers minimal benefit. Such events are unlikely to provide significant insights for mitigation prioritization. Conducting these analyses would also necessitate substantial coordination with other agencies to define scenarios, validate inputs, establish credible modeling parameters and model results.

8. PSPS

De-energization of overhead infrastructure for safety of SDG&E's communities during extreme fire weather conditions remains a crucial component of the Company's wildfire mitigation strategy. SDG&E understands the challenges that PSPS events create for customers, communities, and public safety partners, especially during extreme fire conditions when access to electricity is crucial. Therefore, the use of PSPS de-energization is used as a measure of last resort when necessary to promote safety during high wildfire risk conditions. SDG&E's primary objective is to maintain public safety during periods of high-fire weather and minimize the scope, duration, and impact of PSPS de-energizations on as many customers as possible.

To calculate the potential impacts of PSPS de-energizations, the duration of de-energization by feeder segment and the number and type of downstream customers affected by de-energization on each feeder segment are considered. These values are used to determine natural unit values for the three consequence attributes.

- Safety Attribute: Safety consequence is estimated based on historical PSPS de-energizations across California and reviewed to understand the frequency, duration, and magnitude (customers affected) of PSPS de-energizations. As the safety impact of a PSPS de-energization is not the same for all customer types, a Customer Type Value Consequence is estimated to represent different levels of safety impacts. Based on subject matter expert assumptions, different weighting (or scaling factors) is applied to each customer meter to increase the number of SIFs downstream of each SCADA sectionalizing device. Customer Type Value Consequence includes:

    - Critical Facilities and Critical Infrastructure: Customers based on the CPUC's De-energization proceeding definition.
    - Community Vulnerability: Access and Functional Needs (AFN) customers based on the CPUC's definition of AFN Customers

- Other: All other customers that do not fall in either the critical or AFN categories

To estimate the number of SIFs per de-energization, 1 fatality per 10 billion customer minutes de-energized is assumed based on a review of historical PSPS de-energizations in California (2018 to 2021).[60,61,62]

- Reliability Attribute: Subject matter expert assumptions for CMI estimates are based on a review of historical CMI values associated with past PSPS de-energizations in the service territory. These CMI estimates are subsequently monetized using the $/CMI value provided in Chapter RAMP-3.
- Financial Attribute: Per customer and per PSPS de-energization, a potential financial impact is estimated based on subject matter expert assumptions based on the per diem rates applicable to San Diego, CA, for the fiscal year 2024, with the assumption of accommodating four family members per electrical meter. A Commercial and Industrial (C&I) multiplier is also included to quantify the reliability impact of these customers during the PSPS de-energization. For Residential customers, a $482 cost per de-energization is estimated using the per diem rates applicable to San Diego, CA, as of September 2024 with the assumption of accommodating four family members per customer meter. For C&I customers, a $1,446 cost per de-energization is estimated.[63]

9. PEDS

The PEDS Consequence model follows a similar approach to the PSPS CoRE model because it is modeled as a reliability outage occurring during extreme fire weather days. The following assumptions are considered to establish PEDS Consequences:

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60 CPUC, *Utility PSPS Reports: Post-De-energization, Pre-Season and Post-Season*, *available at*: https://www.cpuc.ca.gov/consumer-support/psps/utility-company-psps-reports-post-de-energization-and-post-season.

61 Southern California Edison Company, *PSPS Reports to the CPUC*, *available at:* https://www.sce.com/outage-center/outage-information/psps.

62 Pacific Gas & Electric Company, *Public Safety Power Shutoffs*, *available at:* https://www.pge.com/en/outages-and-safety/safety/community-wildfire-safety-program/public-safety-power-shutoffs.html.

63 For FY 2025 per diem rates for San Diego, California refer to: U.S. General Services Administration (GSA), *FY 2024 per diem rates for ZIP Code. Financial values as of February 2025. A factor of three is assumed for C, available at:* https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&city=San+Diego&fiscal_year=2024&state=CA&zip=.Financial+values+as+of+February+2025.+A+factor+of+three+is+assumed+for+C&I+customers=.

- Safety Attribute: The same assumptions used for PSPS SIF estimates are applied to the Safety component of PEDS. PEDS duration estimates are derived from a review of historical PEDS outages. These SIF estimates are then converted into monetary values using the monetization methods outlined in Chapter RAMP-3: Risk Quantification Framework, and the same PSPS fatality per customer minute de-energized ratio is assumed.
- Reliability Attribute: Assumptions for CMI estimates are derived from a review of historical PEDS outage data and are updated as new data becomes available. CMI estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Financial Attribute: Due to the limited data on the financial impacts of a PEDS outage, SDG&E relies on conservative estimates from subject matter experts. These estimates are based on high-level projections of overhead line patrol costs during periods of elevated or extreme fire weather conditions.

These assumptions are revisited at least once a year, so that they remain accurate and relevant for long-term decision making. Additionally, they may be updated based on new findings and insights, particularly in preparation for future events. This continuous improvement approach helps to refine and enhance wildfire mitigation strategies, providing the highest level of safety and reliability for SDG&E's customers.

10. Risk Aversion

Any probabilistic decision-making framework designed to reduce catastrophic events relies on three primary inputs: the probability of an undesirable event occurring, the consequence of that event, and the expected reduction in risk, which includes selecting appropriate mitigation measures. Additionally, it involves evaluating the residual risk remaining in the system after the mitigation is applied and understanding the lifecycle activities and costs associated with reducing either the probability or the consequence of the event.

At a basic level, the risk of an undesirable event is its probability multiplied by its consequence. As a result, on a probability-weighted basis, the risk of a low-consequence, high-probability event might be the same as the risk of a high-consequence, low-probability event. While equating these risk values may be accepted in some risk assessment frameworks, multiple studies suggest that society—and SDG&E's customers—may not view these risks as equivalent.[64] To mathematically distinguish between risk preferences, a risk scaling or aversion function is applied. According to the RDF, a Risk Scaling Function "specifies an attitude towards different magnitudes of Outcomes including capturing aversion to extreme Outcomes or indifference over a range of Outcomes."[65] For example, the magnitude of societal aversion toward low-duration outages is generally thought to be less than the aversion toward a catastrophic large scale wildfire that could result in significant injuries and death, community displacement, and billions of dollars in economic damages.

The WiNGS-Planning model captures this aversion towards catastrophic events to properly align the consequences of potential disasters with society's perception of the costs. By incorporating societal risk aversion into the model, SDG&E aligns the community's and SDG&E's intolerance for rare but severe events, such as large-scale wildfires. This approach helps identify locations (feeder-segments) and prioritize mitigation efforts that address the most significant threats to public safety and infrastructure in SDG&E's service territory.

The degree of risk aversion is typically incorporated into a decision model through a mapping function that converts the measurable consequence—whether it be in dollars, fatalities, outages, or other metrics—into an estimated equivalent societal cost. Informed decisions that are indifferent to the range of risk consequence outcomes that are equivalent on a frequency-adjusted basis follow a "risk-neutral" approach, with a 1:1 ratio of consequence to social cost. Conversely, a risk-averse approach maps consequences to societal costs using a convex nonlinear function that disproportionately weights the consequences from high-impact events relative to their frequency, such as a catastrophic wildfire, compared to lower-consequence events that under a risk neutral approach would be considered equivalent.

The primary motivation for incorporating a Risk Aversion function into SDG&E's risk-informed decision framework is to recognize aversion to catastrophic events. These events not only incur substantial costs due to loss of life and physical destruction but also impose

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64 Griesmeyer, J. M., Simpson, M., and Okrent, D. 1980. Use of risk aversion in risk acceptance criteria?, available at https://doi.org/10.2172/5230500; *see also* Hammerton, M., Jones-Lee, M.W., and Abbott, V. 1982 Technical Note—Equity and Public Risk: Some Empirical Results. Operations Research 30(1):203-207. https://doi.org/10.1287/opre.30.1.203 Griesmeyer, J. M., Simpson, M., and Okrent, D. 1980. Use of risk aversion in risk acceptance criteria?, available at https://doi.org/10.2172/5230500.

65 D.24-05-064, Appendix A at A-5.

significant intangible social and economic impacts on the affected communities. By integrating the risk aversion framework described in Chapter RAMP-3: Risk Quantification Framework,[66] SDG&E aims to better account for these potential impacts and prioritize wildfire mitigation measures in the riskiest areas of its service territory.

Table 7 illustrates SDG&E's wildfire, PSPS, and PEDS risk levels, measured in millions of dollars in SDG&E's service territory, incorporating a risk aversion attitude at various points of the distribution. Understanding not only the expected average annual loss (AAL) but also the full spectrum of potential outcomes is crucial for risk assessment and selection and prioritization of mitigation. Table 8 illustrates SDG&E's wildfire, PSPS, and PEDS risk levels without SDG&E's risk aversion attitude.

Table 7: Monetized Risk Estimates with Risk Aversion

Percentile	Annual Return Period (Years)	Wildfire Risk (M$)	PSPS Risk (M$)	PEDS Risk (M$)	Overall Utility Risk (M$)
p50	20	$ 14	$ 61	$ 5	$ 168
p98	50	$ 36,061	$ 766	$ 16	$ 36,196
p99	100	$ 51,962	$ 845	$ 18	$ 52,098
p100	---	$ 210,379	$ 2,804	$ 38	$ 211,202
AAL	1	$ 2,883	$ 132	$ 6	$ 3,021

Table 8: Monetized Risk Estimates without Risk Aversion

Percentile	Annual Return Period (Years)	Wildfire Risk (M$)	PSPS Risk (M$)	PEDS Risk (M$)	Overall Utility Risk (M$)
p50	20	$ 14	$ 61	$ 5	$ 155
p98	50	$ 3,235	$ 754	$ 16	$ 3,381
p99	100	$ 4,141	$ 833	$ 18	$ 4,290
p100	---	$ 13,334	$ 2,756	$ 38	$ 13,624
AAL	1	$ 340	$ 131	$ 6	$ 476

SDG&E continuously refines and optimizes model methodology, inputs, assumptions, and technical solutions, including cloud computing and frontend visualizations so that it remains

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66 *See* Chapter RAMP-3: Risk Quantification Framework at 23-25.

a robust tool for grid-hardening decision-making. Additionally, collaborations with stakeholders such as other investor owned utilities, regulatory bodies, and other stakeholders may lead to updates and enhancements in the model.

WiNGS-Planning key assumptions and known limitations are summarized in Attachment E.

C. Risk Informed Strategy and Prioritization

For the past 17 years, SDG&E has avoided utility-related catastrophic wildfires in its service territory, despite being located in an area with some of the highest wildfire risk in the nation. This is, in part, because of its ongoing efforts to target and effectively mitigate risk through data-driven and risk-informed programs tailored to each location. SDG&E employs a data-driven and risk-based approach to identify and implement tailored mitigation strategies that address the unique characteristics and vulnerabilities of each location within its service territory. By prioritizing long-term benefits and lifecycle costs, SDG&E aims to make financially sustainable choices that maximize safety, reliability, and operational efficiency.

SDG&E's long-term risk reduction strategy not only considers the expected reduction in risk through appropriate mitigation measures but also evaluates the residual risk remaining after these mitigations are applied. This strategy involves understanding the lifecycle costs associated with activities that reduce the probability or the consequence of wildfire risk events as well as the impacts of PSPS de-energizations. By analyzing ongoing operations and maintenance activities (*e.g.*, time-based inspections and vegetation management), operational efficiency, and potential savings from avoided risks, SDG&E prioritizes grid-hardening investments that offer the greatest long-term benefits at reasonable cost. The ultimate goal is to reduce wildfire risk, enhance system resilience, lower overall costs, and minimize disruptions for customers, thereby promoting a safer and more reliable energy infrastructure.

SDG&E considers two primary system hardening mitigations: strategic undergrounding of electric lines and installing covered conductor. Strategic undergrounding of electric lines converts overhead systems to underground, providing the dual benefits of significantly reducing utility-related wildfire risk and the need for PSPS de-energizations. Covered conductor is an electrical conductor that is covered with insulating material to reduce the risk of electrical faults and improve safety. This term refers to conductors equipped with three extruded layers: a semi-conducting sheath, an insulating polyethylene sheath, and an abrasion-resistant XLPE external cover, offering protection against incidental contact.

Although the initial cost of deploying strategic undergrounding exceeds the initial cost of deploying combined covered conductor, an internal analysis of SDG&E's total lifecycle costs, including both installation and long-term operational expenses, revealed that strategic undergrounding is more cost-effective for most feeder segments in the HFTD. Undergrounding significantly reduces or eliminates routine maintenance costs such as vegetation management, wood pole intrusive inspections, drone and overhead visual inspections, and costs associated with PSPS de-energizations. Consequently, undergrounding not only enhances system reliability and safety but also offers substantial long-term financial benefits compared to covered conductor.

1. Mitigation Prioritization and Selection Process

SDG&E's wildfire mitigation strategy continues to provide a hybrid grid hardening approach, aimed at balancing long-term risk reduction with the cost of installing combined covered conductor mitigations and undergrounding of electric infrastructure.

Wildfire Risk Drivers include downed conductors, foreign object/vegetation contacts, and equipment failures. Of these, risk drivers tied to overhead line risk exposure represent the greatest risk. Mitigations that are evaluated in the WiNGS-Planning model are strategic undergrounding of electric lines and installing covered conductor combined with advanced protection settings, as these initiatives are the most effective at reducing risk events on utility equipment. SDG&E's wildfire mitigation strategy continues to provide a hybrid grid hardening approach, aimed at balancing long-term risk reduction with the cost of installing combined covered conductor mitigations and undergrounding of electric infrastructure.

SDG&E conducts a cost-benefit analysis to compare the expected risk reduction and lifecycle costs of Strategic Undergrounding and Combined Covered Conductor, which is used to prioritize grid hardening mitigation. This analysis helps prioritize grid hardening efforts by identifying the most effective and cost-efficient solutions for each feeder segment within Tier 2 and Tier 3 of the HFTD.

Grid hardening measures are chosen for each feeder segment individually, rather than at the Class or Tranche level. This selection process involves evaluating the potential risk reduction estimates, as well as upfront installation and lifecycle costs. Lifecycle costs encompass not only the initial investment in mitigation measures but also the ongoing costs of maintenance, operations, and potential upgrades. Mitigations are modeled for Combined Covered Conductor and Undergrounding with an assumed lifespan of 55 years to align with the Electrical Undergrounding Plan (EUP) risk modeling reporting requirements established by the Commission and Energy Safety.[67]

By evaluating these costs over the expected lifespan of a project, SDG&E aims to balance maximization of long-term benefits rather than simply minimizing upfront expenditures. Without proper consideration of lifecycle costs, solutions that appear the least costly in the short term may lead to higher overall costs over time due to maintenance, failures, or inefficiencies. Lifecycle cost analysis helps select, justify, or reject mitigation investments and avoids opting for a mitigation simply because it appears to have the lowest up-front costs.

SDG&E utilizes the cost benefit analysis to quantify Wildfire and PSPS Risk baselines and risk reductions and prioritize mitigations at the circuit segment level. This strategy identifies strategic undergrounding as the optimal long-term approach for segments with high Wildfire and/or PSPS Risk due to lifecycle cost benefits as well as the following:

- Undergrounding costs are expected to decrease as efficiencies are gained through implementing new construction technology, reducing trench depths and conduit size when applicable, strategic bidding, and bundling projects.
- While the installation of Combined Covered Conductor can reduce PSPS Risk during low to moderate Santa Ana weather events, it is not effective during extreme fire weather conditions with high wind gusts. Additional PSPS Risk reduction is achieved through undergrounding, which nearly eliminates the risk of overhead lines sparking fires during adverse weather conditions.
- Undergrounding also enhances the resilience and reliability of the electrical grid by protecting infrastructure from environmental hazards such as flying debris, lightning strikes, vegetation and animal contacts. This results in fewer reliability outages, thereby improving overall system performance, ensuring a more stable and dependable power supply for communities.

The WiNGS-Planning model provides a quantitative assessment of Wildfire and PSPS Risk reduction and, based on model data, makes a preliminary recommendation for either Combined Covered Conductor or Undergrounding mitigation at each feeder segment. Once the outputs from WiNGS-Planning are reviewed and approved by the Risk Analytics team, the

[67] SB 884, Ch. 819 (2021-2022), Section 2(f)(1); *see also* CPUC, Electric Undergrounding Expediting Program – SB 884, available at https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/risk-assessment-and-safety-analytics/electric-undergrounding-sb-884.

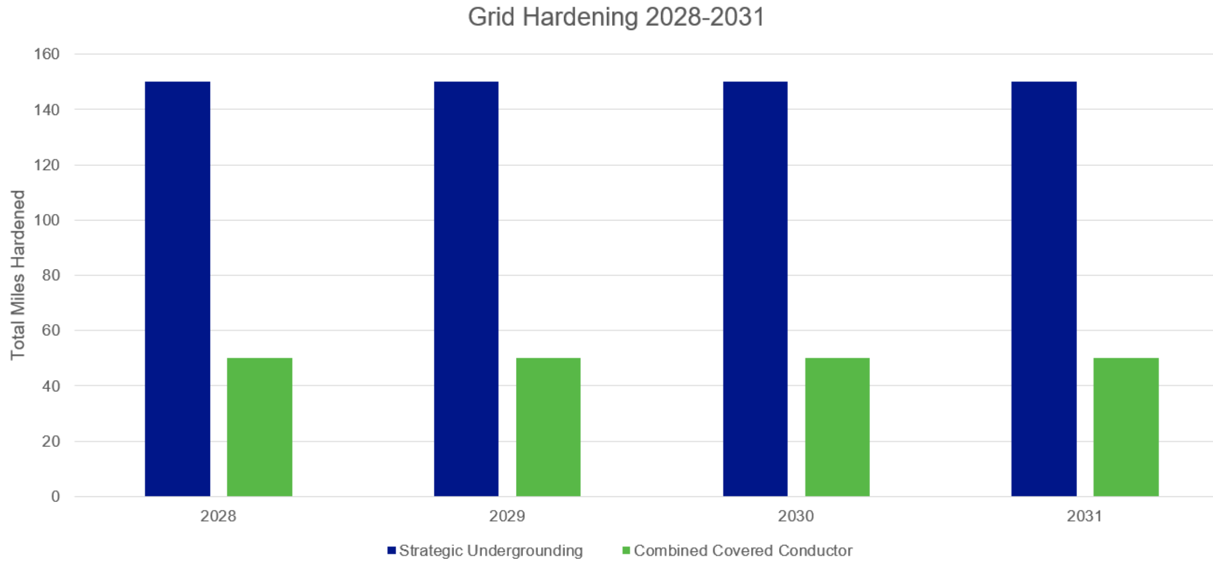
identified mitigations undergo a desktop feasibility analysis informed by subject matter expertise that includes considerations such as geography, routing and trenching, pole loading, asset engineering standards, environmental factors, permitting, and other concurrent hardening projects. Subject matter experts, including Electric System Hardening engineers, fire coordination personnel, meteorologists, risk data scientists, and construction engineers review the cost-benefit ratios.

SDG&E is currently developing an optimization algorithm to identify feeder-segments that could present net cost reduction opportunities if bundled together for implementation and construction. The optimization algorithm selects feeder segment bundles that, when upgraded, would minimize the anticipated residual Wildfire and PSPS Risks while maintaining a cost-benefit ratio greater than 1 (*i.e.*, a net benefit) for the upgraded bundle. The algorithm produces a list of projects consisting of bundled segments eligible for combined covered conductor and undergrounding. Potential cost efficiencies of the identified bundles are then determined, and cost-benefit ratios are updated in order to inform mitigation selection.

2. Overall Risk Reduction

Since 2007, SDG&E has been proactively addressing the risk of catastrophic wildfires within its service territory. SDG&E has invested in state-of-the-art technologies such as weather monitoring systems, high-definition cameras, and satellite imagery to enhance early detection and response capabilities. Additionally, SDG&E has undertaken extensive vegetation management programs, including regular trimming and removal of hazardous trees, to minimize the risk of power lines coming into contact with energized assets. These initiatives are complemented by the installation of combined covered conductor and the strategic undergrounding of power lines in high-risk areas. SDG&E's long-term mitigation strategy takes into account the full portfolio of circuit segments in the HFTD and aims to balance affordability and risk reduction by implementing mitigation investments at a more gradual pace to reach a majority of its wildfire risk reduction and reduce reliance on PSPS de-energizations by 2037. Once grid hardening mitigations are deployed, the remaining risk in the system would be managed through operational mitigations, such as PSPS de-energization and SRP.

Figure 5: Grid Hardening 2028-2031



Risk methodology will continue to be refined and targets will continue to be revised to optimize the portfolio of undergrounding electric lines and installation of combined covered conductor. SDG&E is dedicated to working with industry partners, academic institutions, stakeholder groups, and other IOUs to continually improve its risk models to enhance accurate of the expected impacts of future climate change on Wildfire Risk. SDG&E will revise its current risk model methodology as new scientific data emerges and evaluations are carried out.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section describes the controls and mitigations comprising the portfolio of mitigations for Wildfire and PSPS Risk and reflects expected changes to recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). A current activity that is included in the plan may be referred to as a control and/or a mitigation. Table 9 shows which control activities were in place in 2024 and which are expected to be ongoing, completed, or new during the 2025 to 2031 time period. Because the TY 2024 GRC proceeding established rates through 2027,[68] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[69] For the TY 2028 GRC, SoCalGas/SDG&E calculated CBRs

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[68] *See* D.24-12-074.

[69] *See,* D.21-11-009 at 136, Conclusion of Law 7 (providing a definition for "baselines" and "baseline risk").

beginning with TY 2028 and for each Post-Test Year (2029, 2030, and 2031).[70]

Table 9: Wildfire and PSPS
2024-2031 Control and Mitigation Plan Summary[71]

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C501	Wireless Fault Indicators	X	Discontinued 2025
C502	Capacitor Maintenance and Replacement Program (SCADA)	X	Completed 2024
C504	Standby Power Program (Fixed Backup Commercial)	X	Ongoing
C506	Microgrids	X	Ongoing
C507	CMP Repairs	X	Ongoing
C508	Advanced Protection	X	Ongoing
C510	Hotline Clamps	X	Merged with Combined Covered Conductor
C512	Customized Resiliency Assessments	X	Ongoing
C516	Generator Assistance Program	X	Ongoing
C518	Strategic Undergrounding	X	Ongoing
C520	Distribution Overhead System Hardening	X	Ongoing
C522	Transmission Overhead Hardening (Distribution Underbuild)	X	Ongoing
C524	Lightning Arrestor Removal/Replacement Program	X	Merged with Combined Covered Conductor
C526	**Distribution Overhead Detailed Inspections**	**X**	**Ongoing**
C528	Distribution Infrared Inspections	X	Discontinued 2026
C530	**Distribution Wood Pole Intrusive Inspections**	**X**	**Ongoing**
C534	Risk-Informed Drone Inspections	X	Ongoing
C536	**Distribution Overhead Patrol Inspections**	**X**	**Ongoing**
C546	Aviation Firefighting Program	X	Ongoing
C548	Wildfire Infrastructure Protection Teams	X	Ongoing
C550	Combined Covered Conductor	X	Ongoing
C552	PSPS Sectionalizing Enhancements	X	Ongoing

70 In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

71 Controls/Mitigations identified in this table are organized according to WMP category, as noted in Section IV.A, *infra*.

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C559	LiDAR Flights	X	Ongoing
C564	Distribution Communications Reliability Improvements (DCRI)	X	Discontinued 2026
C565	**Transmission Overhead Detailed Inspections**	**X**	**Ongoing**
C568	Strategic Pole Replacement	X	Ongoing
C569	Cleveland National Forest Fire Hardening		Program Complete – Trailing Costs Only
C570	Expulsion Fuse Replacements	X	Merged with Combined Covered Conductor
C573	Early Fault Detection	X	Ongoing
C576	**Avian Protection**	**X**	**Merged with Combined Covered Conductor**
C537	Off-Cycle Patrol	X	Ongoing
C540	Fuels Management	X	Ongoing
C544	**Pole Clearing**	**X**	**Ongoing**
C551	**Prune and Removal (Clearance)**	**X**	**Ongoing**
C554	**Detailed Inspections**	**X**	**Ongoing**
C555	Vegetation Restoration Initiative	X	Discontinued 2025
C578	QA/QC of Veg Management	X	Ongoing
C561	Fire Potential Index	X	Merged with C572 Situational Awareness and Forecasting
C562	Weather Station Maintenance and Calibration	X	Ongoing
C572	Situational Awareness and Forecasting	X	Ongoing
C556	Engagement with AFN Populations	X	Ongoing
C557	Public Outreach and Education Awareness	X	Ongoing
C560	Mylar Balloon Alternative	X	Completed 2021
C567	Public Emergency Communication Strategy	X	Ongoing
C571	Emergency Preparedness and Recovery Plan	X	Ongoing
C566	Enterprise Data Foundation	X	Ongoing
C575	Vegetation Management Enterprise System	X	Ongoing
C563	Wildfire Mitigation Strategy Development	X	Ongoing
C558	Risk Methodology and Assessment	X	Ongoing
M503	Grounding Banks		New

Bold indicates this control/mitigation includes mandated programs/activities.

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[72] (*i.e.,* activities in this section were in place as of December 31, 2024, or have historical costs tied to them). Controls that will continue as part of the risk mitigation plan are identified in Table 9.

Consistent with its 2026-2028 Base WMP, this chapter presents the following categories:

- Grid Design, Operations and Maintenance
- Vegetation Management and Inspections
- Situational Awareness and Forecasting
- Emergency Preparedness, Collaboration and Public Awareness
- Enterprise Systems
- Wildfire Mitigation Strategy
- Risk Methodology and Assessment

1. Grid Design, Operations, and Maintenance

SDG&E's grid hardening programs are aimed at reducing the risk of wildfires caused by utility equipment and minimizing the impacts of PSPS de-energizations on customers. Programs such as the Combined Covered Conductor Program and Strategic Undergrounding Program can prevent risk events from occurring across several drivers such as energized wire down and foreign object contact. Other programs such as the Advanced Protection Program do not prevent risk events but instead reduce the chance that a risk event will result in an ignition by utilizing protection settings and/or equipment that address specific failure modes known to lead to an ignition. Both types of programs reduce LoRE (*i.e*., are preventative), but affect different stages of the ignition-risk sequence.

Other programs, such as the PSPS Sectionalizing Enhancement Program and generator programs, reduce the impacts of PSPS de-energizations on customers. Strategic undergrounding reduces the need for mitigations such as PSPS de-energizations while also reducing the risk of utility-caused wildfires.

SDG&E's inspection and maintenance programs are intended to identify and resolve equipment conditions on the grid before failures occur. Mandatory inspection programs are

[72] D.18-12-014 at 33.

governed by the CPUC's GO 165 and GO 95 and focus on finding and mitigating safety and reliability conditions and are supplemented by risk-informed drone inspections. Maintenance practices generally aim to resolve conditions based on priority level and location, with accelerated remediation timeframes for conditions found on equipment in Tier 3 of the HFTD.

SDG&E's grid design, operations, and maintenance programs include:

- **C501: Wireless Fault Indicators:** Wireless Fault Indicator (WFI) devices are used to monitor electricity distribution lines and locate faults more efficiently and accurately using Low Power Communication Network (LPCN) communication to alert distribution system operators where a fault on a line or circuit has occurred. WFIs can detect faults without having a minimum continuous current on the line and therefore can be used at remote locations that have very little load. Distribution operators can then dispatch electric troubleshooters close to the exact fault location to quickly identify and isolate the fault and begin service restoration. Due to manufacturer upgrades that resulted in incompatibility with current communications (*see* the 2025 WMP Update for details), the WFI program is being discontinued. Installed WFIs will continue to be utilized for situational awareness.
- **C502: Capacitor Maintenance and Replacement Program (SCADA):** The SCADA Capacitors Maintenance and Replacement Program was developed to replace existing non-SCADA capacitors with a more modern SCADA-switchable capacitor or to remove non-SCADA capacitors if not required for voltage or reactive support. The SCADA Capacitors Maintenance and Replacement Program prioritizes replacing or removing fixed capacitors from service and then addresses capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor, which have a monitoring system to check for imbalances and isolate internal faults before they become catastrophic. SCADA capacitors also have the capacity for remote isolation and monitoring of the system, which provides additional situational awareness during extreme weather conditions. While this program will not reduce capacitor faults, the advanced protection equipment is designed to detect and isolate issues before a capacitor rupture occurs, reducing the failure mode most likely to lead to an

ignition.

- **C504: Standby Power Program (Fixed Backup Power Commercial):** The Standby Power Program targets non-residential customer sites that provide community service in HFTD portions of the service territory and are in regions served by circuits that experience frequent PSPS outages. Depending on site requirements, feasibility, and costs, the program offers backup power solutions to enhance resiliency, including permanent standby generators, permanent backup batteries powered by solar arrays, and related equipment. The program identifies sites based on meter, circuit, and PSPS de-energization, and assesses potential backup power solutions to enhance resiliency of the building and in support of the community it serves to mitigate the impacts of PSPS de-energizations.
- **C506: Microgrids:** The Microgrid Program operates permanent and temporary microgrids (*i.e.*, backup generators) that can be electrically isolated during a PSPS de-energization, thereby maintaining electric service to customers within the microgrid boundary. The majority of microgrids are in the HFTD. Microgrids located outside the HFTD are aimed at reducing PSPS impacts to areas frequently impacted by PSPS de-energizations. SDG&E utilizes weather forecasting technologies to identify locations where pre-determined backup generators and microgrids locations could be engaged during a PSPS de-energization. As part of the pre-determination process for temporary microgrids, backup generators are appropriately sized prior to deployment to maintain adequate load support for impacted customers. Additionally, conventional generators and mobile batteries are deployed to create temporary microgrid solutions to support communities and CRCs and, to the extent feasible, minimize traditional generator run-time during extended PSPS de-energizations. SDG&E plans to install one remote grid by 2028, which will provide standalone, decentralized energy resources and utility infrastructure for continuous, permanent energy delivery in lieu of providing retail distribution services using traditional utility infrastructure (*e.g.*, distribution lines). This remote grid solution can mitigate otherwise costly hardening efforts for long distribution lines with minimal customer loading. The Remote Grid program was approved by the CPUC via Resolution E-5308 on March 21, 2024.

- **C507: CMP Repairs:** SDG&E's Corrective Maintenance Program (CMP) helps mitigate wildfire risk by providing information about the condition of the electric distribution system, including facilities within the HFTD. Potential infractions can then be addressed before they result in a safety or reliability risk event. All equipment is maintained with a time-based inspection cycle and corrective repair work is performed in adherence with, and sometimes exceeding, GO 95 timeframes.
- **C508: Advanced Protection:** The Advanced Protection Program (APP) develops and implements advanced protection technologies within electric substations and on the electric distribution system. It aims to prevent or mitigate the risks of fire incidents, provide better transmission and distribution sectionalization, create higher visibility and situational awareness in fire-prone areas, and allow for the implementation of new relay and automation standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults. Advanced technologies such as microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, private LTE, and wireless communication radios comprise the portfolio of devices that are installed to allow for a more comprehensive protection system and greater situational awareness in fire-prone areas of the HFTD.
- **C510: Hotline Clamps:** Connectors that have been connected directly to overhead primary conductors, known as hotline clamps (HLCs), are associated with creating a weak connection that could result in a wire down event. This in turn could lead to an energized wire coming into contact with either the ground or a foreign object where it could become a source of ignition. The HLC Replacement Program replaced HLCs that are connected directly to overhead primary conductors with compression, wedge, or other approved connections. HLC connections are installed concurrently with other asset replacement initiatives across the HFTD such as avian protection, fuse replacements, and lightning arrestor replacements. C510 Hotline Clamps will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the

workpapers associated with this chapter.

- **C512: Customized Resiliency Assessments:** The Customized Resiliency Assessments (CRA) Program provides customers frequently impacted by PSPS de-energizations with resiliency assessments. Customers are provided information to help prepare for potential de-energizations and wildfires, such as 211 San Diego, Community Resource Centers, and services offered by Community Based Organizations. Participating customers are also evaluated for potential backup power solutions including permanent and portable options and may be referred to the Generator Assistance Program (GAP) or other programs as appropriate. The program also provides qualifying customers with options to request temporary backup power solutions during periods when SDG&E's Emergency Operations Center (EOC) is activated for potential PSPS de-energizations.
- **C516: Generator Assistance Program:** The GAP offers rebates for portable fuel generators and portable power stations to encourage customers to acquire backup power options to mitigate the impacts of PSPS de-energizations. The target audience is customers who reside within Tiers 2 and 3 of the HFTD and have experienced at least one PSPS de-energization since 2019. Eligible customers receive program materials via mail and email campaigns and are directed to an online portal to verify account information and learn more about the program. In addition, customers enrolled in customer assistance programs are eligible for an enhanced rebate on these backup power solutions. The program also provides the option for customers to receive one rebate for a fuel generator and one rebate for a portable power station to accommodate various backup power needs.
- **C518: Strategic Undergrounding:** The Strategic Undergrounding Program converts overhead systems to underground, providing the dual benefits of significantly reducing wildfire risk and the need for PSPS de-energizations. This program is deployed in the HFTD and considers both Wildfire and PSPS Risk. The Strategic Undergrounding Program is primarily prioritized and scoped through the use of the WiNGS-Planning model, hardening scope considerations, subject matter experts, and local conditions.

  To calculate the wildfire risk reduction for strategic undergrounding of electric lines, data on historical ignitions associated with underground equipment, pre-mitigation overhead system risk event rates, and ignitions rates were analyzed. Because undergrounding is estimated to be 98.92 percent effective,[73] it does not require concurrent deployment of advanced protection as it will not enhance risk reduction. However, other activities like EFD, enhanced infrared inspections, and Power Quality (PQ) monitoring could be deployed for reliability and infrastructure integrity benefits.

Strategic undergrounding of electric lines is the most effective method of reducing wildfire risk as it reduces the impact of overhead line risk exposure and the likelihood for high winds to adversely impact grid assets. Additionally, it reduces the need for PSPS de-energizations if all overhead exposure in a circuit is undergrounded. Given the high number of overhead miles in the service territory, cost-benefit calculations developed in the WiNGS-Planning model suggest prioritization of strategic undergrounding of electric lines within the HFTD. Data on historic PSPS de-energizations, wind conditions, and other criteria are reviewed to determine where undergrounding of electric lines will have the largest impact to address local risk drivers.

- **C520: Distribution Overhead System Hardening:** The Distribution Overhead System Hardening Program is focused on areas within the HFTD and includes the replacement of wood poles with steel, the replacement of conductors, and in some cases the permanent removal of overhead facilities.
- **C522: Transmission Overhead Hardening (Distribution Underbuild):** Transmission Overhead Hardening replaces wood poles with steel poles, replaces aging conductors with high-strength conductors, and increases conductor spacing in the HFTD to reduce the chance of risk events and ignitions. Distribution Underbuild replaces overhead distribution equipment that is attached to the same poles and along the same route as the work that is completed through overhead transmission hardening. SDG&E achieves cost efficiencies by including Distribution Underbuild work with overhead transmission work, which can

[73] See Attachment F for further details regarding the effectiveness of covered conductor and strategic undergrounding.

combine charges such as design and labor.

- **C524: Lightning Arrestor Removal/Replace Program:** Lightning arrestors are pieces of electrical equipment designed to mitigate the impact of transient overvoltage on the electric system. However, if the overvoltage duration is too long or too high, the arrestor can become thermally overloaded and fail in such a way that they become an ignition source. The Lightning Arrestors Replacement Program installs CAL FIRE-approved lightning arrestors to mitigate the impact of transient overvoltage on the electric system. CAL FIRE-approved lightning arrestors are equipped with an external device that operates prior to the arrestor overloading, greatly reducing the potential of becoming an ignition source. C524 Lightning Arrestor Removal/Replace Program will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C526: Distribution Overhead Detailed Inspections:** Distribution overhead detailed inspections include a thorough visual assessment of the pole, attachments, and conductor and cables. Where appropriate, individual pieces of equipment may be opened, tested, or operated to assess their condition. In addition, if warranted, the use of infrared or other tools (*e.g.*, drones, binoculars, measurement devices) may be utilized. Inspection records are maintained that include the circuit, area, facility or equipment inspected, the inspector, the date of the inspection, and any problems (or items requiring corrective action) identified during each inspection, as well as the scheduled date of corrective action. Corrective maintenance items identified are prioritized to meet or exceed the timeframes required in GO 95, Rule 18. This prioritization considers the component identified, the location of the structure and surrounding terrain, and the severity of the condition.
- **C528: Distribution Infrared Inspections:** Distribution Infrared Inspections utilizes infrared technology to examine the radiation emitted by connections to find potential issues with a connection before failure. Thermographers capture and assess thermal imagery that may indicate an abnormality on the system. Findings are documented and required repair work is tracked through completion.

- **C530: Distribution Wood Pole Intrusive Inspections:** An intrusive inspection typically involves a visual assessment of the pole for any structural damage or deterioration, a sound and bore of the pole to identify internal cavities, and an excavation around the pole base below the ground line. Below-ground excavation may not be possible where the pole is encased in concrete or where there are other obstacles, such as fences, walls, landscaping or rock. The data is used to calculate the remaining pole strength utilizing industry standards. The pole passes inspection if the calculated remaining strength is greater than 80 percent. If the calculated remaining strength is less than 80 percent, the pole is recommended for reinforcement or replacement.
- **C534: Risk-Informed Drone Inspections:** The Risk-Informed Drone Inspection (RIDI) Program uses drones to collect imagery, improving traditional ground inspections by providing a "birds eye view" of overhead facilities, as well as high resolution imagery of overhead equipment and components. The use of drones to collect imagery enhances an inspector's ability to identify potential fire hazards related to certain types of issues or where conditions such as terrain and vegetation density make full detailed inspections challenging. Issues that are more readily observed by drones include damaged arrestors, damaged insulators, issues with pole top work, issues with armor rods, crossarm or pole top damage, exposed connections, loose hardware, improper splices, and damaged conductors. Images and inspection findings have also been used to build asset identification and damage detection models to support Intelligent Image Processing (IIP) technology, which is used to process imagery data, improve the quality of the RIDI assessments, and enhance the inspection risk prioritization model.
- **C536: Distribution Overhead Patrol Inspections:** Distribution overhead patrol inspections consist of a visual inspection of applicable utility equipment and structures and are designed to identify obvious structural problems and hazards. Distribution overhead patrol inspections may be satisfied by other inspections, such as overhead detailed inspections or risk-informed drone inspections.
- **C546: Aviation Firefighting Program**: The Aviation Firefighting Program focuses on reducing the consequences of wildfires through suppression of fire

spread. Under certain conditions, a wildfire that is not suppressed may grow rapidly and uncontrollably, endangering public safety and electrical infrastructure. Fire agencies could divert local aerial resources to fight wildfires outside of the service territory, leaving the service territory with limited or no aerial firefighting resources. To mitigate this risk, the aviation firefighting program serves as a wildfire suppression resource, ensuring aerial firefighting resources remain available in the region.

- **C548: Wildfire Infrastructure Protection Teams:** Work activities and associated fire mitigations throughout the service territory are designated for specific Fire Potential Index (FPI) ratings (*e.g.*, Normal, Elevated, Extreme, or RFW) as defined in ESP 113.1 SDG&E Operations and Maintenance Wildland Fire Prevention Plan. As the fire potential increases, activities that present an increased risk of ignition have additional mitigation requirements. Where risk cannot be mitigated, work activity might cease. When work activities reach a level of fire risk where a dedicated resource is required, SDG&E uses qualified fire resources with specific training and experience, referred to as CFRs. While these resources can be ordered throughout the year, SDG&E takes the proactive step of supplying field crews with 12 to 17 CFRs once the fire environment and FPI indicate elevated risk, typically from June through the end of November. SDG&E also works to align with the seasonal staffing of local, state, and federal agencies in the service territory. The use of CFRs is not limited to the HFTD, as SDG&E's protocols require a dedicated fire patrol for specific activities when they are performed adjacent to wildland fuels and there is elevated risk present.
- **C550: Combined Covered Conductor:** The Combined Covered Conductor Program replaces bare conductors with covered conductors in the HFTD. Covered conductors are manufactured with an internal semiconducting layer and external insulating ultraviolet-resistant layers to provide incidental contact protection. The WiNGS-Planning model is utilized to prioritize installation within the HFTD. SDG&E performs a comprehensive assessment of existing assets to determine if pole replacements are necessary in conjunction with covered conductor installation based on detailed pole loading calculations. The need for new

electrical equipment, such as fuses, transformers, and lightning arrestors, is also considered and new assets are installed alongside covered conductors. Furthermore, advanced protection solutions like Early Fault Detection (EFD) and Falling Conductor Protection (FCP) are assessed and implemented to enhance the system's effectiveness against various risk drivers. The evaluation of additional sectionalizing devices to minimize the number of customers affected by PSPS de-energizations is also conducted, with new devices potentially being installed. Overhead asset inspections and vegetation management activities also continue on lines with covered conductor. Additionally, PSPS de-energizations and Sensitive Relay Profiles (SRP) may be utilized during periods of extreme fire weather. These additional mitigation measures enhance the effectiveness of covered conductor installations against ignitions to an estimated 58 percent.[74]

Covered conductors are effective at reducing risk events on utility equipment and can raise the threshold for PSPS de-energizations to higher wind speeds compared to bare conductor hardening. For example, during the PSPS activation that occurred from December 9 to December 11, 2024, the wind gust threshold was increased from 45 miles per hour to 50 miles per hour for two feeder segments with covered conductor installed.

- **C552: PSPS Sectionalizing Enhancements:** The PSPS Sectionalizing Enhancement Program installs sectionalizing devices in strategic locations, improving the ability to isolate high-risk areas for potential de-energization. For example, switches are installed on predominantly underground circuits, allowing customers on the underground portion of the circuit to remain energized during weather events. Additionally, weather station data is used with sectionalizing devices to target de-energizations to sections of circuits that are experiencing extreme wind events.
- **C559: LiDAR Flights:** Light Detection and Ranging (LiDAR) inspections on distribution lines are primarily used to support grid hardening design efforts. Distribution systems are often changing with joint use additions, customer

[74] *See* Attachment F for further details regarding the effectiveness of covered conductor and strategic undergrounding.

relocations, compliance, reliability and maintenance modifications, conductor creep and pole settling, external development, and other potential hazards, which can impact the ability of the electric line design to mitigate the risk of wildfires. LiDAR surveys provide a cost effective, scalable, and accurate solution for overhead power line analysis, increasing both system reliability and safety. LiDAR funds are spent primarily on post-construction surveys (including auditing contractor activities), then pre-construction designs, and finally vegetation analysis.

- **C564: Distribution Communications Reliability Improvements:** A reliable communication network is necessary for many initiatives that require continuous communication. The current communication system within the HFTD has little bandwidth to support technologies deployed as wildfire mitigations, including Advanced Protection and Falling Conductor Protection. In addition, there are gaps in coverage of third-party communication providers in the rural areas of eastern San Diego County that limit the ability to communicate with field personnel during RFW crew deployments and EOC activations. To mitigate this risk, the DCRI Program was developed to deploy a privately-owned LTE network using licensed radio frequency spectrum, enhancing the reliability of the communication network.
- **C565: Transmission Overhead Detailed Inspections:** For transmission overhead detailed inspections, qualified inspectors (patrollers) visit every structure scheduled for inspection on a 3-year interval cycle, visually assessing all components of the structure and conductor for current and future maintenance requirements. Identified conditions are assigned internal condition codes that are used to prioritize the condition based on the risk and severity. This prioritization considers the component identified, the location of the structure and surrounding terrain, and the severity of the condition. It also prioritizes work to meet or exceed the timeframes required in GO 95, Rule 18. SDG&E notes that the transmission line inspection programs are driven by FERC-jurisdictional projects. This filing provides only the CPUC jurisdictional projects.
- **C568: Strategic Pole Replacement:** The Strategic Pole Replacement program

targets high-risk poles in fire prone areas of the service territory, including Tier 2 and 3 of the HFTD that are gas treated (also known as Cellon treatment) and set in concrete or soil and are otherwise not forecast to be addressed by other programs. Because the average age of gas treated poles is 50 years, these poles are nearing the end of their useful life and are known to have a higher failure potential. Gas treated poles have a higher propensity for dry rot due to the pole's interaction with moisture in the soil, and poles set in concrete are more difficult to inspect. Poles identified through the Pole Loading Remediation Program are also included in the scope of this program. These poles will be replaced or will require pole-top only work to remediate issues identified through pole loading calculations. This may include pole replacement, pole-top re-arrangement, re-tensioning of primary and/or secondary conductor, anchor modifications, or other modifications as necessary.

Permitting, land rights, environmental mitigation, customer concerns, or a combination of these factors can impact the pole replacement and/or pole top work schedule. Where feasible, poles are bundled together to minimize the impact to the community and gain efficiency in the design, environmental, permitting, land rights, and construction process.

- **C569: Cleveland National Forest Fire Hardening:** SDG&E operates and maintains a network of electric facilities located within the Cleveland National Forest (CNF). In 2016, SDG&E received a Master Special Use Permit (MSUP) to operate and maintain these facilities. Specifically, the MSUP allows SDG&E to develop a series of projects and activities aimed at increasing the safety and reliability of existing electric facilities within and near the CNF, including. the fire-hardening of facilities and selective undergrounding of several existing 12-kilovolt (kV) and 69-kV electric facilities spread throughout an approximately 880 square-mile area in the eastern portion of San Diego County. Generally, the CNF program will increase the safety and reliability of SDG&E's system by fire-hardening existing electric infrastructure that currently serves the U.S. Forest Service, emergency service facilities (*i.e.*, fire, communication, and other), campgrounds, homes, businesses, and other customers within the CNF and surrounding areas. Projects were completed in 2021 and costs included in this chapter are trailing costs to support the CNF Post Line Restoration Project (PLRP), which provides post-construction habitat restoration required by project permits for temporarily impacted mitigatable vegetation communities. This program is complete; however, trailing costs will continue until 2030.

- **C570: Expulsion Fuse Replacements:** Expulsion fuses connected to the distribution system provide protection when the system experiences a fault or overcurrent. These fuses operate by creating a significant expulsion within the fuse, resulting in the fuse opening and isolating the fault, which limits further damage to other equipment. However, this external discharge has the potential to ignite flammable vegetation. The Expulsion Fuse Replacement Program replaced existing expulsion fuses with new, safer expulsion fuses that are approved by CAL FIRE. These new expulsion fuses reduce the discharge expelled into the atmosphere, reducing the chance of a fuse operation leading to an ignition.
- **C570 Expulsion Fuse Replacements** will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C573: Early Fault Detection:** Electrical equipment failures can cause significant damage, impact customer and employee safety, have high repair costs, and result in extended outages to customers. However, recent advances in power quality waveform analysis, relaying, radio frequency, and other technologies have made it possible for utilities to identify and predict failures before they occur. The EFD Program utilizes various technologies to detect what are known as incipient faults on the system with enough time to locate and potentially fix or replace equipment prior to it permanently failing. These incipient faults occur on failing pieces of equipment long before they fail violently and cause damage to the surrounding area.
- **C576: Avian Protection:** The Avian Protection Program installs avian protection equipment on distribution poles in the service territory to prevent electrocution of birds and to facilitate compliance with federal and state laws. The program is aimed at improving reliability and reducing the risk of faults and wire-down

events associated with avian contact, which can lead to ignitions. Avian protection equipment is installed concurrently with other asset replacement initiatives across the HFTD such as HLC replacements, fuse replacements, and lightning arrestor replacements. C576 Avian Protection will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.

2. Vegetation Management and Inspections

Vegetation management is comprised of the assessment, intervention, and management of vegetation in proximity to electrical infrastructure, including pruning and removal of trees and other vegetation around electrical infrastructure for safety, reliability, and risk reduction. SDG&E's Vegetation Management Program consists of the following activities: Detailed Inspections, Off-Cycle Patrols, Tree Pruning and Removal, Pole Clearing, Auditing, and Fuels Management. These activities involve several components, including tracking and maintaining a database of inventory trees and poles, detailed and off-cycle inspections, pruning and removing trees for conductor clearance, replacing unsafe trees with compatible species, and quality compliance to verify work quality and contractual adherence. The Vegetation Management System (VMS), called PowerWorkz, is used to track and record inventory assets (trees and poles) and manage work activities.

- **C537: Off-Cycle Patrol:** Off-Cycle Patrols are performed in the HFTD. Vegetation within the utility strike zone is assessed for tree growth and hazard potential. Off-Cycle Patrols also target Century plant (*Agave americana*) and bamboo because of their relatively fast and unpredictable growth. The inspector determines any work that is required prior to the next routine scheduled tree pruning based on the Vegetation Management Area's (VMA's) activity schedule. Off-Cycle Patrols are performed by ISA-Certified Arborists who may be internal SDG&E employees (Patrollers) or contracted personnel. Inventory tree records for vegetation that require work are also updated.
- **C540: Fuels Management**: The Fuels Management activity is a discretionary activity performed in the HFTD that reduces risk in high fire threat areas that could result from equipment failure or a wire-down event. This mitigation measure is intended to protect infrastructure in the event of a wildfire that

originates outside of SDG&E rights-of way. The scope of the activity involves thinning vegetation at ground level within a 50-foot radius surrounding the pole. Vegetation is reduced to approximately 30 percent ground cover within the cleared radius. Native and sensitive species are selectively retained where possible. This activity is predominantly performed around poles that are subject to the requirements of Public Resources Code Section 4292 because the ignition risk at these locations is relatively higher due to the equipment on the pole.

- **C544: Pole Clearing:** Pole clearing is a mandatory activity of maintaining a fuel break around power poles that are subject to the clearance requirement by removing vegetation that could ignite or propagate a fire. Pole clearing is required within the State Responsibility Area (SRA) to comply with Public Resources Code Section 4292 for poles that carry specific, "non-exempt" equipment. Non-exempt equipment may arc, spark, or fail, causing hot particles to fall to the ground, potentially resulting in an ignition. Public Resources Code Section 4292 requires clearing of vegetation at ground level within a 10-foot radius from the outer circumference of non-exempt poles and towers (also called "subject" poles and towers). Public Resources Code Section 4292 also requires removal of live vegetation to a height of 8 feet above ground within the 10-foot cylinder, and the removal of dead vegetation within the cylinder up to the height of the conductors. Poles with exempt equipment are not subject to the pole clearing activity.
- **C551: Prune and Removal (Clearance):** Tree pruning and removal is the activity of cutting vegetative material for the purpose of maintaining safe, reliable, and compliant clearance between trees and overhead electrical conductors. The Tree Pruning and Removal Activity follows American National Standards Institute (ANSI) A300 and International Society of Arboricultural (ISA) best management practices. Clearances established at time-of-pruning are determined by multiple factors including species, growth rate, minimum required clearance, wind sway, line sag, proper pruning practices, and tree health and must be sufficient to provide safety and compliance for at least one annual cycle. Enhanced tree pruning is performed within the HFTD where fire risk is considered elevated or extreme. Enhanced clearances are defined as greater than

12 feet from the conductor and exceed the clearance recommended by the CPUC within GO 95, Rule 35 within the HFTD. Enhanced clearances generally pertain to the pruning of targeted species and the removal of any tree species within the HFTD.

- **C554: Detailed Inspections:** Detailed Inspections are performed annually throughout the HFTD and consist of a Level 2 inspection for trees in the utility strike zone. A Level 2 inspection is a 360-degree visual assessment of trees located within the utility strike zone evaluating the crown, trunk, canopy, and above-ground roots for hazards to the overhead electric facilities. The utility strike zone is defined as the area where trees are tall enough to impact the overhead facilities. Detailed inspections are conducted concurrently for distribution and transmission conductors where they are collocated within the utility corridor. Detailed inspections determine whether vegetation will encroach the required minimum clearance distance or otherwise impact the lines within the annual cycle. Detailed Inspections occur annually based on the Master Schedule, which remains static year to year.
- **C555: Vegetation Restoration Initiative:** The Vegetation Restoration Initiative represents multiple programs supporting SDG&E's overall sustainability goal. These programs include the Tree Sustainability Program; Customer Tree Rebate Program; and the Tree Removal/Replacement Program.
    - The Tree Sustainability Program provides SDG&E customers and external stakeholders such as cities, communities, and Tribal governments free trees for planting. This program supports the "right-tree, right-place" philosophy of planting trees that are compatible to grow near power lines.
    - The Customer Tree Rebate Program provides qualifying residential customers rebates that incentivize planting trees to help provide direct environmental, health, and economic benefits. This program was designed for customers in parts of SDG&E's service territory where tree canopy was limited and where planting trees could make a positive impact in a community.
    - The Tree Removal/Replacement Program provides eligible customers the

incentive to allow SDG&E to remove incompatible trees growing near power lines and to provide replacement species that are safe. SDG&E targets palm, eucalyptus, and other fast-growing species that require repeated and costly pruning in order to maintain near power lines.

All three programs help support SDG&E's goal to provision (plant or provide) 100,000 trees in its service territory by 2035.

- **C578: QA/QC of Vegetation Management:** Quality assurance audits of vegetation management activities (Detailed Inspections, Pruning and Removal, and Pole Clearing activities) are performed to measure work quality, contractual adherence, compliance with regulations and standards, and data accuracy. A third-party contractor performs the quality assurance audits of vegetation management activities. QA/QC of Vegetation Management audits.

3. Situational Awareness and Forecasting

Situational awareness and forecasting consists of the Fire Science and Climate Adaptation (FSCA) business unit, tools, and technologies to enhance wildfire preparedness; climate resilience; and collaboration with experts to develop solutions for preventing ignitions, mitigating fire impacts, and building a resilient region.

- **C561: Fire Potential Index:** The Fire Potential Index (FPI) is a daily forecast that is generated to communicate the wildfire potential for any given day, thereby promoting safe and reliable operations. This 7-day forecast classifies fire potential based on weather conditions, fuel states, and historical fire occurrences. The FPI reflects key variables such as the state of native grasses across the service territory (green-up), fuels (ratio of Dead Fuel Moisture component to Live Fuel Moisture component), and weather (sustained wind speed and dew point depression). Each of these variables is assigned a numeric value and those individual numeric values are summed to generate a Fire Potential value from 0 to 17 that expresses the degree of fire threat expected for each of the 7 days included in the forecast. The numeric values are grouped into "Normal," "Elevated," and "Extreme." C561: Fire Potential Index was merged C572 Situational Awareness and Forecasting in 2024. This is reflected in the workpapers associated with this chapter.

- **C562: Weather Station Maintenance and Calibration:** The Weather Station Network consists of 223 strategically placed weather stations across the service territory that transmit data on wind speed, gusts, direction, temperature, and humidity every 10 minutes using cellular and spread spectrum communications. Data is transmitted to SDG&E's publicly available website Weather Awareness System (https://weather.sdgeweather.com/). Furthermore, 217 weather stations (approximately 97 percent) can be remotely enabled to report data every 30 seconds during critical fire weather conditions. Over the past decade, this data has been used to analyze weather patterns within the service territory and to generate statistics such as the 95th percentile, 99th percentile, and maximum values for wind gusts, which are essential for informed decision-making during extreme weather events. These statistics are updated annually to maintain accuracy and relevance.
- **C572: Situational Awareness and Forecasting:** The Fire Science and Climate Adaptation (FSCA) business unit is comprised of meteorologists, climate adaptation advisors, and fire coordinators. This business unit is dedicated to responding to and strategizing for wildfire preparedness activities and climate resilience-related deliverables. The Wildfire and Climate Resilience Center (WCRC), which opened in 2024, brings leading thinkers and problem solvers in academia, government, and the community together to create forward-looking solutions to help prevent ignitions, mitigate the impacts of fires, and ultimately help build a more resilient region.

  Situational awareness and forecasting is supported by various tools and technologies, such as the Weather Station Network, satellites such as GOES-18/-17 and the Advanced Baseline Imager (ABI) that aid in fire detection, and high-performance computing clusters that generate weather data for operations and the FPI, a model that calculates the wildfire potential based on weather, fuel conditions, and historical fire occurrences on any given day, assisting in safe and reliable operations.

4. Emergency Preparedness, Collaboration and Public Awareness

SDG&E's Emergency and Disaster Preparedness Plan (the Company Emergency and

Disaster Preparedness Plan or CEADPP) was developed in compliance with Pub. Util. Code § 768.6(a) as a guide to govern emergency response efforts, including wildfire and PSPS emergency preparedness. This plan is part of the overall emergency response plan framework.

The Wildfire Safety/PSPS Community Awareness campaign educates customers and the general public about the risk of wildfires and PSPS de-energizations through online webinars, Wildfire Safety Fairs, and outreach advisors who work with local community-based organizations to amplify messaging. The Tribal Relations team implements culturally appropriate communications and outreach based on feedback from Tribes via listening sessions, online surveys, and focus groups. During PSPS activations, customer notifications, media updates, in-community signage, and situational awareness postings are used across social media, including social media toolkits that are shared with community partners to reach a broad audience. Assistance and resource access are provided to those who are directly impacted by wildfires and/or PSPS activations. Emergency residential and non-residential customer protections are provided for wildfire victims, as ordered by the CPUC.[75]

SDG&E regularly engages with local governments at various levels. The Regional Public Affairs team engages senior and elected officials while the Emergency Management team works with first responders and other emergency management agencies. SDG&E participates in a series of weekly and monthly meetings with other California IOUs to strategize and align where possible on wildfire and PSPS mitigations. Additionally, the Company has a membership with Chartwell, Inc., a national membership group for gas and electric utilities, that collaborates on problem-solving opportunities and events to help utilities improve customer experience and operational efficiency.

- **C556: Engagement with AFN Populations:** SDG&E conducts a dedicated campaign focused on communicating with customers with AFN. The AFN campaign promotes available resources and services during PSPS de-energizations through its robust support model and partnerships with entities such as 211, Facilitating Access to Coordinated Transportation (FACT), and the Salvation Army. Additionally, the campaign promotes collaboration with local

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75 SDG&E filed Advice Letter 3177-E/2645-G on January 26, 2018, in compliance with Resolution M-4835 dated January 11, 2018, which was approved on February 21, 2018, and made effective December 7, 2018. *See also*D.19-05-039 and D.19-07-015.

Community Based Organizations (CBO) across the service territory, including organizations within SDG&E's Energy Solutions Partner Network.

- **C557: Public Outreach and Education Awareness:** Implementation of outreach and awareness programs is done through approximately 50 CBOs from the Energy Solutions Partner Network that are either located in or serving customers in the HFTD. These CBOs are leveraged to provide notification support before, during, and after an event. SDG&E also partners with several CBOs to jointly host a series of Wildfire Safety Fairs and Mini Wildfire Safety Fairs, which target both HFTD communities and hard-to-reach customers in the HFTD. These events are held in partnership with local organizations and internal departments and share key information about how to prepare for a wildfire, PSPS de-energization, or other potential emergencies. Feedback is also solicited from event attendees and responses are used to improve future outreach efforts.
- **C560: Mylar Balloon Alternative:** SDG&E worked with a major balloon manufacturer to pursue the development of a non-conductive balloon. SDG&E brought expertise in electrical engineering and the distribution power grid, and the balloon manufacturer brought expertise in manufacturing processes and retail commercialization. Both companies worked collaboratively to develop a prototype non-conductive balloon that will not cause an electrical fault when it comes in contact with overhead distribution power lines. They also drafted an industry standard to test balloons to identify whether a balloon will cause a fault to overhead distribution power lines that, if adopted by local authorities, could be used to limit the sale of balloons that don't pass the test.
- **C567: Public Emergency Communication Strategy:** The Wildfire Safety Public Education and Outreach plan increases community resiliency to wildfires and mitigates the impact of PSPS de-energizations. The plan is divided into three phases: prior to, during, and following a wildfire or PSPS de-energization. Prior to an anticipated PSPS de-energization, mass communication efforts focus on educating customers and the public. During a wildfire or PSPS activation, notifications, media updates, in-community signage, and situational awareness postings are used across social media and SDG&E's external-facing online

messaging to provide the latest real-time updates to customers and the general public. Social media toolkits are also developed and shared with community partners to help reach a broader audience. Key communications are available in 22 prevalent languages. Notifications are amplified by SDG&E's expansive AFN CBO partner coalition, made up of trusted agencies within the AFN community, including Residencial Care Facilities, Social Service agencies, and AFN and medical support organizations. After a wildfire or PSPS de-energization, communications to customers and the general public are reviewed and evaluated for future improvements and an engagement survey is sent to all public safety partners. Feedback is then used to improve customer and public communications and outreach efforts for the following year.

- **C571: Emergency Preparedness and Recovery Plan:** SDG&E's CEADPP provides an all-hazards strategic framework that SDG&E personnel rely on to respond effectively using the Incident Command System (ICS) and National Incident Management System (NIMS) (ICS-NIMS) required by federal and state mandates. This plan is developed, updated, and maintained in compliance with GO 166 as modified by D.98-07-097, D.00-05-022, D.12-01-032, D.14-05-020, and D.21-05-019. The CEADPP addresses emergency preparedness, crisis management, and business resumption planning to provide for the safety of employees, contractors, customers, and the public and to provide protection of property in the event of an incident affecting employees, contractors, customers, or other stakeholders.

5. Enterprise Systems

Enterprise Systems are comprehensive, integrated software platforms designed to manage and streamline various business processes and functions across SDG&E. They incorporate advanced technologies and analytics to enhance efficiency, transparency, and decision-making. Key components include:

- Asset Management and Inspection Enterprise System: Utilizes advanced technology and analytics, integrating data from systems such as Asset 360 and IIP to develop and enhance risk-informed strategies and improve transparency in asset management.

- Vegetation Management Enterprise System: Enhances asset tracking, data analytics, and scheduling capabilities to better manage vegetation management activities. It also includes advanced analytics for proactive vegetation inspection.
- Enterprise Data Foundation: Focuses on migrating data from on-premise systems to the Amazon Web Services (AWS) Cloud, ensuring a robust and scalable data infrastructure.
- Risk Assessment Systems: Enhances risk modeling capabilities to better assess and manage potential risks.
- **C566: Enterprise Data Foundation**: The Enterprise Data Foundation is a centralized system designed to manage and optimize data related to wildfire mitigation and asset management. This foundation involves the migration of data from on-premise systems to the AWS cloud, establishing data migration patterns, and implementing processes for data validation, integrity, and data governance to enhance quality throughout the migration journey. The Enterprise Data Foundation advances asset management capabilities, enables the development of advanced analytics, supports data auditability and the development of a WMP data catalog, provides end users with visualization tools to interact with the data effectively, and supports the automation of WMP-related reporting processes. By utilizing combined data, it enhances the ability to manage assets, assess risks, and make informed decisions to optimize business operations.
- **C575: Vegetation Management Enterprise System:** Vegetation Management utilizes the software system PowerWorkz to inventory vegetation and manage inspections. PowerWorkz uses the CityWorks software platform and is the server side where Scheduling Work Orders and Dispatch Work Orders are created and submitted. The mobile application (Epoch) is the mapping interface contractors use for data entry to record completed work. Epoch includes GIS layers, electric infrastructure, land ownership, and parcel information, and houses the electronic records for all tree and pole assets.

6. Wildfire Mitigation Strategy

SDG&E uses a comprehensive approach to wildfire mitigation in its effort to promote public and system safety in the face of increasing fire and PSPS Risks. SDG&E's wildfire mitigation strategy continues to evolve with enhancements made to risk modeling, and methodology continues to be refined to not only consider initial investments but also conduct a comprehensive and detailed analysis of the lifecycle costs of various mitigation alternatives, ensuring that the most cost-effective and sustainable solutions are implemented. By examining and comparing factors such as operations and maintenance, operational efficiency, and potential savings from avoided risks, SDG&E can prioritize grid-hardening investments that offer the greatest long-term benefits.

- **C563: Wildfire Mitigation Strategy Development:** The Wildfire Mitigation department manages and oversees the wildfire mitigation program, which aims to reduce the risk of wildfires and minimize the impact of PSPS de-energizations on customers. The department leads various wildfire mitigation initiatives, including supporting regulatory and legislative activities related to fire mitigation. It also fosters collaboration efforts with other utilities and external stakeholders and develops innovative ways to advance existing wildfire mitigations. The department also tracks and monitors Wildfire Mitigation program progress and metrics, leads the utility wildfire mitigation maturity model, spearheads vision projects, promotes new methods to enhance fire safety, and explores advancements to drive further improvement and change. This includes tracking WMP activities, complying with reporting requirements, and providing governance specifications and procedures.

7. Risk Methodology and Assessment

Comprehensive risk modeling identifies, quantifies, and mitigates wildfire risks, with the ultimate intent of safeguarding communities and enhancing the resilience of SDG&E's electrical grid. Improving the prediction of potential hazards enables the creation of risk-informed strategies that improve financial planning, situational awareness, and resource allocation. Additionally, risk methodology and assessment aims to develop advanced analytics and predictive models to support ongoing WMP and Risk Management initiatives. This includes the creation of a data lake and machine learning pipelines to leverage readily available cloud machine learning and artificial intelligence capabilities to proactively identify, reduce, and manage wildfire-related risk. It will enhance data quality by utilizing and validating centralized datasets, ensuring the consumption of accurate data in risk models. Additionally, it will expedite iterations, improving the overall efficiency of the process. There will be a core set of re-usable, cloud-based data science workspaces and tools to enable sustainable and faster model creation and feedback loops that evaluate and validate the utility workload. Additionally, third party consultants and/or contractors are engaged to provide detailed analyses around industry best practices, consequence modeling, independent review, and project management support.

- **C558: Risk Methodology and Assessment:** Risk methodology and assessment focuses on enhancing analytics capabilities and refining risk models to better inform decision-making. The program manages and refines its risk modeling improvement plan, which incorporates the evaluation of additional factors such as climate vulnerability assessment and further segmentation of risk drivers. Additionally, the program enhances modeling design and architecture, enabling the tracking and validation of various model risk components, establishing a formalized process for conducting independent reviews, and expanding the use of models to inform the selection and prioritization of initiatives beyond the installation of covered conductors and undergrounding of electric lines.

B. Changes from 2024 Controls

SDGE plans to discontinue the following controls:

- **C501 Wireless Fault Indicators** will be discontinued because the current wireless fault indicators were discontinued by the manufacturer. These units communicate with On-Ramp but do not communicate with SCADA, which makes them obsolete as a wireless indicator. However, installed WFIs will continue to be used manually by field personnel as a fault indicator.
- **C502 Capacitor Maintenance and replacement program (SCADA)** was completed in 2024.
- **C510 Hotline Clamps, C524 Lightning Arrestor Removal/Replace Program, C570 Expulsion Fuse Replacements, and C576 Avian Protection** will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C528 Distribution Infrared Inspections** will be discontinued in 2026 because the program yielded an extremely low find rate. In 2024, 6,656 inspections were completed with a Level 1 find rate of 0.045% and a Level 2 find rate of 0.916%.

Infrared technology will continue to be used during routine and responsive patrols and inspections as needed to help identify and mitigate any potential issues.

- **C564 Distribution Communications Reliability Improvements** will be discontinued beginning in 2026, as SDG&E has focused its investments on projects that have the greatest impact on risk reduction in the HFTD. While the DCRI project provides communication for advanced protection projects, it has a lower impact on risk reduction compared to other programs. Communication needs for specific projects will be addressed as they are built out, rather than proactively. Currently, there is no identified replacement for the program.
- **C555 Vegetation Restoration Initiative** has been indefinitely paused beginning in 2025, as SDG&E has focused its investments on projects that have the greatest impact on risk reduction in the HFTD.
- **C560 Mylar Balloon Alternative** was completed in 2021.
- **C561: Fire Potential Index** was merged with C572 Situational Awareness and Forecasting in 2024 in 2024. This is reflected in the workpapers associated with this chapter.

C. Mitigation Programs

SDGE intends to implement the following new mitigation program:

- **M503: Grounding Banks:** This program intends to remove all distribution line grounding banks from 12-kV circuits with overhead HFTD exposure by extension of a new overhead primary neutral conductor. Distribution line grounding banks were installed over several decades until new installations were discontinued in September 2020. Grounding banks were a cost reduction measure that eliminated the need for a primary neutral conductor when new underground subdivisions were added to the system. In compliance with GO 95, they prohibited the reliance on earth grounds to carry line currents during normal operations. However, grounding banks tend to redirect fault current levels for many types of faults, making it more difficult to maintain reliable, consistent operation of protective devices. This may prevent protective devices from accurately detecting safety hazards such as an energized wire down. Therefore, a design constraint was implemented that allowed up to three grounding banks for a given 12-kV circuit (grounding banks are not installed on 4-kV circuits). Nearly all distribution line grounding banks are installed on poles. Projects under this program will be prioritized to resolve circuits in the HFTD. Circuits with three grounding banks will be prioritized first, circuits with then two grounding banks, then circuits with one grounding bank.

D. Climate Change Adaptation

Pursuant to Commission decisions[76] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a CAVA focused on the years 2030, 2050, and 2070 with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities with the goals of promoting safety and reliability of its services and mitigating the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in this chapter align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. All controls and mitigations within the Wildfire and PSPS Risk chapter are applicable to climate adaptation planning due to their alignment with increasing resilience to wildfire. For additional information on the CAVA and a complete list of climate-relevant controls and mitigations included in RAMP, refer to Chapter RAMP-5: Climate Change Adaption.

E. Foundational Programs

Foundational programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[77] These programs do not directly contribute to risk reduction

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[76] D.19-10-054; D.20-08-046.

[77] D.24-05-064, Appendix A at A-4.

but are foundational to SDG&E's wildfire mitigation efforts.

Table 10 lists the Foundational Programs that are applicable to the Wildfire and PSPS Risk and the mitigation activities that they support.

Table 10: Wildfire and PSPS Foundational Activities (Direct, in 2024 $ thousands)

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
C504	Standby Power Program (Fixed Backup Power Commercial)	All Overhead Programs*	1,000	-
C512	Customized Resiliency Assessment	All Overhead Programs*	3,953	-
C516	Generator Assistance Program	All Overhead Programs*	489	-
C546	Aviation Firefighting Program	All Overhead Programs*	4,503	5,339
C548	Wildfire Infrastructure Protection Teams	All Overhead Programs,* C518 Strategic Undergrounding	4,820	-
C562	Weather Station Maintenance and Calibration	All Overhead Programs,* C518 Strategic Undergrounding	-	7,616
C572	Situational Awareness and Forecasting	All Overhead Programs,* C518 Strategic Undergrounding	4,496	-
C556	Engagement with AFN Populations	All Overhead Programs,* C518 Strategic Undergrounding	1,719	-
C557	Public Outreach and Education Awareness	All Overhead Programs,* C518 Strategic Undergrounding	605	-
C567	Public Emergency Communication Strategy	All Overhead Programs,* C518 Strategic Undergrounding	8,706	9,219
C571	Emergency Preparedness and	All Overhead	21,720	29,592

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
	Recovery Plan	Programs,* C518 Strategic Undergrounding		
C566	Enterprise Data Foundation	All Overhead Programs,* C518 Strategic Undergrounding	2,020	43,475
C575	Vegetation Management Enterprise System	All Overhead Programs*	327	-
C563	Wildfire Mitigation Strategy Development	All Overhead Programs,* C518 Strategic Undergrounding	5,045	-
C558	Risk Methodology and Assessment	All Overhead Programs,* C518 Strategic Undergrounding	5,754	27,818
C564	Distribution Communications Reliability Improvements	All Overhead Programs,* C518 Strategic Undergrounding	2,287	10,615

* *All Overhead Programs include the following: C506 Microgrids, C508 Advanced Protection, C520 Distribution Overhead System Hardening, C522 Transmission Overhead Hardening (Distribution Underbuild), C526 Distribution Overhead Detailed Inspections, C536 Distribution Overhead Patrol Inspections, C537 Off-Cycle Patrol, C540 Fuels Management, C544 Pole Clearing (Brushing), C550 Combined Covered Conductor, C551 Prune and Removal (Clearance), C522 PSPS Sectionalizing Enhancements, C554 Detailed Inspections, C565 Transmission Overhead Detailed Inspections, C568 Strategic Pole Replacement, and C573 Early Fault Detection.*

Capital and Operations and Maintenance (O&M) foundational costs are modeled as annual costs per mile in SDG&E's workpapers. Depending on the program, these costs are allocated based on subject matter expert consideration as follows:

1. If a program only affects combined covered conductor, 100% of the cost is assigned to this mitigation and 0% is assigned to strategic undergrounding. For example: C546: Aviation Firefighting Program in Table 10.
2. If a program mostly supports combined covered conductor, 75% of the cost is assigned to this mitigation and 25% is assigned to strategic undergrounding. For example: C567: Public Emergency Communication Strategy in Table 10.
3. If a program supports both combined covered conductor and strategic

undergrounding initiatives, the costs are split equally. For example: C566: Enterprise Data Foundation; C558: Risk Methodology and Assessment in Table 10.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for Wildfire and PSPS Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. Costs are estimated using assumptions provided by subject matter expertise and available data. In compliance with the Phase 3 Decision,[78] for each enterprise risk, SDG&E uses actual results and industry data, when available, and supplemented the data with input from subject matter experts. Additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

Table 11: Wildfire and PSPS
Control and Mitigation Plan –Recorded and Forecast Costs Summary
(Direct, in 2024 $ thousands)

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C501	Wireless Fault Indicators	3	0	0	0	0	0
C502	Capacitor Maintenance and replacement program (SCADA)	189	0	0	0	0	0
C504	Standby Power Program (Fixed Backup Power Commercial)	0	0	1,000	0	0	3,000
C506	Microgrids	7,096	1,019	1,273	910	0	3,819
C507	CMP Repairs	10,298	176	250	48,570	36,915	750
C508	Advanced Protection	11,048	188	188	13,803	2,530	564
C510	Hotline Clamps	684	47	0	146	0	0
C512	Customized Resiliency Assessment	0	3,792	3,953	0	0	11,859
C516	Generator Assistance Program	0	489	489	0	0	1,467
C518	Strategic Undergrounding	213,171	1,069	1,709	517,688	1,038,773	4,410
C520	Distribution Overhead System Hardening	3,564	1,555	420	11,659	280	420

78 D.24-05-064, RDF Row 10.

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C522	Transmission Overhead Hardening (Distribution Underbuild)	12,460	1	1	17,470	503	3
C524	Lightning Arrestor Removal/Replace Program	2,664	0	0	539	0	0
C526	**Distribution Overhead Detailed Inspections**	**0**	**116**	**801**	**0**	**0**	**2,403**
C528	Dist. System Inspection IR/Corona	0	139	0	0	0	0
C530	**Distribution Wood Pole Intrusive Inspections**	**0**	**73**	**1,451**	**0**	**0**	**5,078**
C534	Risk-Informed Drone Inspections	73,111	31,210	11,053	88,866	38,391	35,295
C536	**Distribution Overhead Patrol Inspections**	**0**	**284**	**284**	**0**	**0**	**852**
C537	Off-Cycle Patrol	0	1,352	1,495	0	0	4,660
C540	Fuels Management	0	3,523	5,445	0	0	16,335
C544	**Pole Clearing (Brushing)**	**0**	**7,121**	**8,998**	**0**	**0**	**28,920**
C546	Aviation Firefighting Program	3,009	7,665	4,503	5,339	0	13,509
C548	Wildfire Infrastructure Protection Teams	0	4,820	4,820	0	0	14,460
C550	Combined Covered Conductor	75,037	1,886	1,832	277,897	170,449	3,894
C551	**Prune and Removal (Clearance)**	**0**	**30,337**	**31,424**	**0**	**0**	**101,279**
C552	PSPS Sectionalizing Enhancements	2,178	0	0	7,875	3,150	0
C554	**Detailed Inspections**	**0**	**3,724**	**4,859**	**0**	**0**	**15,742**
C555	Vegetation Restoration Initiative	0	926	0	0	0	0
C556	Engagement with AFN Populations Total	0	1,496	1,719	0	0	5,157
C557	Public Outreach and Education Awareness	0	530	605	0	0	1,815
C558	Risk Methodology and Assessment	4,745	5,753	5,973	15,896	11,922	17,919
C559	LiDAR Flights	0	31	2,500	0	0	0
C560	Mylar Balloon Alternative	0	2	0	0	0	0
C561	Fire Potential Index	0	0	0	0	0	0

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C562	Weather Station Maintenance and Calibration	116	0	0	352	7,264	0
C563	Wildfire Mitigation Strategy Development	678	4,120	5,306	0	0	15,918
C564	Distribution Communications Reliability Improvements (DCRI)	21,336	796	945	10,615	0	2,833
C565	**Transmission Overhead Detailed Inspections**	**1,043**	**6**	**15**	**4,582**	**3,077**	**45**
C566	Enterprise Data Foundation	7,226	0	2,481	29,057	14,418	7,443
C567	Public Emergency Communication Strategy	16,887	6,996	9,528	9,219	0	28,584
C568	Strategic Pole Replacement	2,445	58	168	31,712	23,784	205
C569	Cleveland National Forest Fire Hardening	1,036	232	1	2,085	173	3
C570	Expulsion Fuse Replacements	206	0	0	601	0	0
C571	Emergency Preparedness and Recovery Plan	3,870	20,970	21,383	29,592	0	64,149
C572	Situational Awareness and Forecasting	0	4,421	4,496	0	0	13,488
C573	Early Fault Detection	3,761	3	3	11,896	4,702	9
C574	Air Quality Station Maintenance	0	0	0	0	0	0
C575	Vegetation Management Enterprise System	622	327	327	0	0	981
C576	**Avian Protection**	**1,066**	**17**	**0**	**599**	**0**	**0**
C578	QA/QC of Veg Mgmt	0	3,206	3,424	0	0	10,778
M503	Grounding Banks	0	0	0	436	1,974	0
Total		**479,549**	**150,476**	**145,122**	**1,137,404**	**1,358,305**	**438,046**

Bold *indicates this control/mitigation includes mandated programs/activities.*

Table 12: Wildfire and PSPS
Control & Mitigation Plan – Units Summary

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	Name	Units of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C501	Wireless Fault Indicators	Wireless Fault Indicators	0	0	0	0	0	0
C502	Capacitor Maintenance and replacement program (SCADA)	Capacitors replaced	1	0	0	0	0	0
C504	Standby Power Program (Fixed Backup Power Commercial)	No feasible units	0	0	0	0	0	0
C506	Microgrids	Microgrids	0	0	0	1	0	0
C507	CMP Repairs	Poles	422	0	0	1,914	1,455	0
C508	Advanced Protection	Nodes	18	18	18	158	60	54
C510	Hotline Clamps	Hotline Clamps	678	0	0	197	0	0
C512	Customized Resiliency Assessment	Installations	0	0	100	0	0	300
C516	Generator Assistance Program	Rebates Issued	0	0	250	0	0	750
C518	Strategic Undergrounding	Miles UG	112	112	150	178	450	450
C520	Distribution Overhead System Hardening	Jobs completed	1	0	20	6	0	20
C522	Transmission Overhead Hardening (Distribution Underbuild)	No feasible units	7	0	0	21	0	0
C524	Lightning Arrestor Removal/Replace Program	Lightning Arrestors	1,654	0	0	516	0	0
C526	Distribution Overhead Detailed Inspections	HFTD Inspections	0	16,503	11,537	0	0	15,741
C528	Dist. System Inspection IR/Corona	HFTD Inspections	0	0	0	0	0	0
C530	Distribution Wood Pole Intrusive Inspections	HFTD Inspections	0	0	18,373	0	0	64,779
C534	Risk-Informed Drone Inspections	HFTD Inspections	1,992	6,529	6,500	2,335	1,059	19,500

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	Name	Units of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C536	Distribution Overhead Patrol Inspections	HFTD Patrols	0	86,140	84,678	0	0	254,034
C537	Off-Cycle Patrol	VMA (Vegetation Management Area)	0	106	106	0	0	318
C540	Fuels Management	Structures cleared	0	147	500	0	0	1,500
C544	**Pole Clearing (Brushing)**	**Poles brushed**	**0**	**22,769**	**22,000**	**0**	**0**	**66,000**
C546	Aviation Firefighting Program	N/A	0	0	0	0	0	0
C548	Wildfire Infrastructure Protection Teams	N/A	0	0	0	0	0	0
C550	Combined Covered Conductor	Miles hardened	36	36	50	200	150	150
C551	**Prune and Removal (Clearance)**	**Trees trimmed**	**0**	**90,885**	**91,336**	**0**	**0**	**274,008**
C552	PSPS Sectionalizing Enhancements	Switches installed	18	0	0	25	10	0
C554	**Detailed Inspections**	**Trees inspected**	**0**	**261,975**	**255,000**	**0**	**0**	**765,000**
C555	Vegetation Restoration Initiative	Trees planted	0	0	0	0	0	0
C556	Engagement with AFN Populations Total	No feasible units	0	0	0	0	0	0
C557	Public Outreach and Education Awareness	No feasible units	0	0	0	0	0	0
C558	Risk Methodology and Assessment	No feasible units	0	0	0	0	0	0
C559	LiDAR Flights	Miles	0	0	0	0	0	0
C560	Mylar Balloon Alternative	No feasible units	0	0	0	0	0	0
C561	Fire Potential Index	No feasible units	0	0	0	0	0	0
C562	Weather Station Maintenance and Calibration	Weather sensors	0	0	0	8	6	0
C563	Wildfire Mitigation Strategy Development	No feasible units	0	0	0	0	0	0
C564	Distribution Communications	No feasible units	3	0	0	5	0	0

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	Name	Units of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
	Reliability Improvements (DCRI)							
C565	**Transmission Overhead Detailed Inspections**	**Inspections**	**14**	**2,940**	**2,224**	**175**	**117**	**0**
C566	Enterprise Data Foundation	No feasible units	0	0	0	0	0	0
C567	Public Emergency Communication Strategy	No feasible units	0	0	0	0	0	0
C568	Strategic Pole Replacement	Poles	40	40	200	800	600	400
C569	Cleveland National Forest Fire Hardening	No feasible units	0	0	0	0	0	0
C570	Expulsion Fuse Replacements	Fuses replaced	188	0	0	311	0	0
C571	Emergency Preparedness and Recovery Plan	No feasible units	0	0	0	0	0	0
C572	Situational Awareness and Forecasting	No feasible units	0	0	0	0	0	0
C573	Early Fault Detection	No feasible units	62	0	0	240	180	0
C574	Air Quality Station Maintenance	Other	0	0	0	0	0	0
C575	Vegetation Management Enterprise System	No feasible units	0	0	0	0	0	0
C576	**Avian Protection**	**Poles protected**	**774**	**774**	**0**	**236**	**0**	**0**
C578	QA/QC of Veg Mgmt	No feasible units	0	0	0	0	0	0
M503	Grounding Banks	Feet	0	0	0	14,300	64,500	0

Table 13 presents a summary of CBRs at the mitigation or control level for the TY-2028 GRC cycle. CBRs are calculated based on scaled, expected values unless otherwise noted, and are calculated for each of the three required discount rates in each year of the GRC cycle and for the post-test years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in.

Table 53: Wildfire and PSPS
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C501	Wireless Fault Indicators	$0.0	$0.0	---	---	---
C502	Capacitor Maintenance and Replacement Program (SCADA)	$0.0	$0.0	---	---	---
C504	Standby Power Program (Fixed Backup Commercial)	$0.0	$4.0	---	---	---
C506	Microgrids	$0.9	$5.1	0.00	0.00	0.00
C507	CMP Repairs	$49.2	$1.0	0.00	0.00	0.00
C508	Advanced Protection	$3.8	$0.7	12.43	7.81	7.81
C510	Hotline Clamps	$0.0	$0.0	---	---	---
C512	Customized Resiliency Assessments	$0.0	$15.8	---	---	---
C516	Generator Assistance Program	$0.0	$2.0	---	---	---
C518	Strategic Undergrounding	$1,393.5	$6.1	33.21	13.23	12.91
C520	Distribution Overhead System Hardening	$ 0.6	$0.8	5.64	2.36	2.36
C522	Transmission Overhead Hardening (Distribution Underbuild)	$4.0	$0.0	0.00	0.00	0.00
C524	Lightning Arrestor Removal/Replacement Program	$0.0	$0.0	---	---	---
C526	**Distribution Overhead Detailed Inspections**	$0.0	$3.2	62.67	62.67	62.67
C528	Distribution Infrared Inspections	$0.0	$0.0	---	---	---

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C530	**Distribution Wood Pole Intrusive Inspections**	$0.0	$6.5	16.75	16.87	16.87
C534	Risk-Informed Drone Inspections	$51.2	$46.3	60.38	59.30	59.30
C536	**Distribution Overhead Patrol Inspections**	$0.0	$1.1	190.53	190.53	190.53
C546	Aviation Firefighting Program	$0.0	$18.0	---	---	---
C548	Wildfire Infrastructure Protection Teams	$0.0	$19.3	---	---	---
C550	Combined Covered Conductor	$239.9	$5.7	6.27	4.18	4.06
C552	PSPS Sectionalizing Enhancements	$4.7	$0.0	---	---	---
C559	LiDAR Flights	$0.0	$2.5	---	---	---
C564	Distribution Communications Reliability Improvements (DCRI)	$0.0	$3.8	---	---	---
C565	**Transmission Overhead Detailed Inspections**	$4.2	$0.1	---	---	---
C568	Strategic Pole Replacement	$31.7	$0.4	9.74	4.06	4.06
C569	Cleveland National Forest Fire Hardening	$0.4	$0.0	---	---	---
C570	Expulsion Fuse Replacements	$0.0	$0.0	---	---	---
C573	Early Fault Detection	$6.5	$0.0	157.83	97.17	97.17
C576	**Avian Protection**	$0.0	-	---	---	---
C537	Off-Cycle Patrol	$0.0	$6.2	64.97	64.97	64.97
C540	Fuels Management	$0.0	$21.8	0.60	0.60	0.60
C544	**Pole Clearing**	$0.0	$37.9	15.05	15.05	15.05
C551	**Prune and Removal (Clearance)**	$0.0	$132.7	4.33	4.33	4.33

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C554	**Detailed Inspections**	$0.0	$20.6	28.08	28.08	28.08
C555	Vegetation Restoration Initiative	$0.0	-	---	---	---
C578	QA/QC of Veg Management	$0.0	$14.2	---	---	---
C561	Fire Potential Index	$0.0	$0.0	---	---	---
C562	Weather Station Maintenance and Calibration	$7.4	$0.0	---	---	---
C572	Situational Awareness and Forecasting	$0.0	$18.0	---	---	---
C556	Engagement with AFN Populations	$0.0	$6.9	---	---	---
C557	Public Outreach and Education Awareness	$0.0	$2.4	---	---	---
C560	Mylar Balloon Alternative	$0.0	$0.0	---	---	---
C567	Public Emergency Communication Strategy	$0.0	$38.1	---	---	---
C571	Emergency Preparedness and Recovery Plan	$0.0	$85.5	---	---	---
C566	Enterprise Data Foundation	$20.8	$9.9	---	---	---
C575	Vegetation Management Enterprise System	$0.0	$1.3	---	---	---
C563	Wildfire Mitigation Strategy Development	$0.0	$21.2	---	---	---
C558	Risk Methodology and Assessment	$15.9	$23.9	---	---	---
M503	Grounding Banks	$2.4	$0.0	---	---	---

***Bold** indicates this control/mitigation includes mandated programs/activities.*

Mitigations without CBR values are represented as ---. Refer to Table 14 for CBR commentary.

Refer to the workpaper for tranche-level CBRs by year and in aggregate for each mitigation.

Table 14 provides additional commentary for control and mitigation programs that did not yield quantifiable CBRs.

Table 14: Wildfire and PSPS CBR Commentary

ID	Control/Mitigation Name	Commentary
C501	Wireless Fault Indicators	CBR is not calculated as this control/mitigation is being discontinued in 2025
C502	Capacitor Maintenance and Replacement Program (SCADA)	CBR is not calculated as this control/mitigation was completed in 2024
C504	Standby Power Program (Fixed Backup Power Commercial)	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Predicting customer demand and location needs is challenging, making it difficult to forecast units and calculate an accurate CBR. Mitigation costs are captured in CBR cost assumptions.
C507	CMP Repairs	The exact locations of CMP repairs are currently unknown, making it difficult to quantify CBR for this program. Mitigation cost is captured in the CBR cost assumptions.
C510	Hotline Clamps	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C512	Customized Resiliency Assessment	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. Predicting customer demand and location needs for resiliency assessments is challenging, making it difficult to forecast units and calculate an accurate CBR.
C516	Generator Assistance Program	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. Predicting customer demand and location needs for portable fuel generators is challenging, making it difficult to

ID	Control/Mitigation Name	Commentary
		forecast units and calculate a cost-benefit ratio accurately.
C524	Lightning Arrestor Removal/Replacement Program	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C528	Distribution Infrared Inspections	CBR is not calculated as this control/mitigation will be discontinued in 2026.
C546	Aviation Firefighting Program	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Mitigation costs are captured in CBR cost assumptions.
C548	Wildfire Infrastructure Protection Teams	SDG&E adjusts work activities and fire mitigation measures based on FPI ratings and employs qualified fire resources to support field crews during elevated fire risk periods, typically from June to November, aligning with local, state, and federal agencies' seasonal staffing. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Mitigation costs are captured in CBR cost assumptions.
C552	PSPS Sectionalizing Enhancements	The exact locations of sectionalizing devices that will be installed through this program are currently unknown, therefore, it is difficult to quantify CBR for this program.
C556	Engagement with AFN Populations	The AFN program does not have a CBR because the diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C557	Public Outreach and Education Awareness	Public outreach and education awareness programs do not have a CBR because the diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C558	Risk Methodology and Assessment	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver
C559	LiDAR Flights	The locations of LiDAR flights are currently

ID	Control/Mitigation Name	Commentary
		unknown, making it difficult to quantify CBR for this program.
C560	Mylar Balloon	CBR is not calculated as control/mitigation was completed in 2024.
C561	Fire Potential Index	CBR is not calculated as this control/mitigation was merged with C572 Situational Awareness and Forecasting in 2024.
C562	Weather Station Maintenance and Calibration	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C563	Wildfire Mitigation Strategy Development	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C564	Distribution Communications Reliability Improvements (DCRI)	CBR is not calculated as this control/mitigation will be discontinued in 2026.
C565	**Transmission Overhead Detailed Inspections**	CBR is not calculated because the costs of this mitigation are captured as part of C526: Distribution Overhead Detailed Inspections.
C566	Enterprise Data Foundation	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts, and the work within this program makes it infeasible to identify a single unit of measurement for a CBR. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.

ID	Control/Mitigation Name	Commentary
C567	Public Emergency Communication Strategy	This does not have a CBR because the program encompasses communications and messaging during fires or PSPS de-energizations. The diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C569	Cleveland National Forest Fire Hardening	CBR is not calculated as this control/mitigation is completed.
C570	Expulsion Fuse Replacements	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C571	Emergency Preparedness and Recovery Plan	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C572	Situational Awareness and Forecasting	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C575	Vegetation Management Enterprise System	This program supports vegetation management activities. The work within this program makes it infeasible to identify a single unit of measurement for a CBR.
C576	Avian Protection	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C578	QA/QC of Veg Management	CBR is not calculated as the costs of this mitigation are captured as part of the C544 Vegetation Detailed Inspection. Mitigation cost is captured in the CBR cost assumptions.
M503	Grounding Banks	CBR is not calculated as this is a new mitigation.

Bold *indicates this control/mitigation includes mandated programs/activities.*

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014,[79] SDG&E considered two alternative plans to mitigate Wildfire and PSPS Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, costs, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

Table 15: Wildfire and PSPS
Alternative Mitigation Plan Forecasted Costs Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Forecast Costs			
		Capital (2025-2028)	PTY Capital (2029-2031)	O&M (2025-2028)	PTY O&M (2029-2031)
A520	Grid Hardening Alternative 1	574.1	1,368.2	5.7	13.7
A522	Grid Hardening Alternative 2	425.9	680.7	4.3	6.8

Table 16: Wildfire and PSPS
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A520	Grid Hardening Alternative 1	$472.9	$4.7	16.21	8.93	8.70
A522	Grid Hardening Alternative 2	$276.6	$2.8	7.99	5.39	5.25

A. Grid Hardening Alternative 1 (A520):

Grid Hardening Alternative 1 considers undergrounding approximately 800 miles of electric lines from 2028 to 2031. This approach is the most effective method for mitigating wildfire risk as it virtually eliminates exposure to overhead line risks and greatly reduces the likelihood of high winds causing damage to grid assets. This leads to a substantial decrease in the

79 D.18-12-014 at 33-35.

potential for wildfires ignited by electrical infrastructure. However, an all-underground approach presents several challenges. Although not often, projects can be constrained by permitting and terrain issues. Additionally, upfront installation costs are significantly higher than the current plan to mitigate Wildfire and PSPS Risk through a combination of undergrounding electric lines and installing combined covered conductor. Therefore, while the long-term risk reduction of this alternative is substantial, an optimal mix of grid hardening strategies, which includes both undergrounding of electric lines and installation of combined covered conductor, is more justifiable when weighing the potential benefits, risk reduction, and costs. This balanced approach allows for effective mitigation of wildfire risks while addressing the practical constraints of permitting, terrain, resource availability, and financial considerations.

B. Grid Hardening Alternative 2 (A522):

Grid Hardening Alternative 2 considers installing combined covered conductor on approximately 800 miles of electric lines from 2028 to 2031. This will reduce the likelihood of risk events across some of SDG&E's highest risk Drivers such as foreign object contacts, pole and conductor-related failures. However, the inherent overhead exposure and continued need for PSPS implementation result in high residual risk.

Additionally, this alternative is less cost-effective than the mix of grid hardening mitigations in the current plan to mitigate Wildfire and PSPS Risk. The lifecycle costs associated with the installation of combined covered conductor are higher due to ongoing maintenance and the need for periodic replacements. In contrast, an optimal mix of grid hardening strategies, which includes both undergrounding of electric lines and the installation of combined covered conductor, is more justifiable when weighing the potential benefits, risk reduction, and overall costs. This balanced approach provides a more effective and cost-efficient solution for mitigating wildfire risks and ensuring long-term grid reliability.

VI. HISTORICAL GRAPHICS

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify the remaining tasks necessary to continue mitigating risks.

Figure 6: Grid Hardening: Cumulative

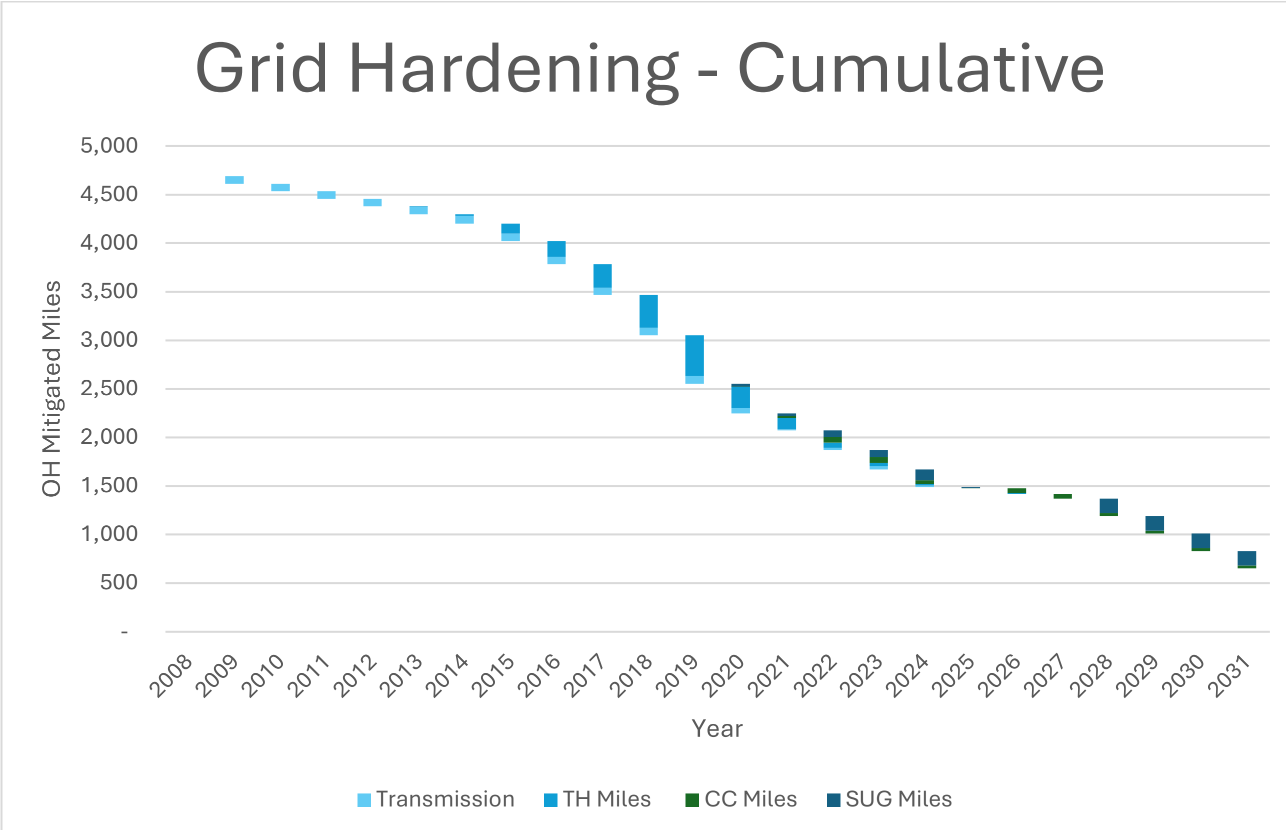
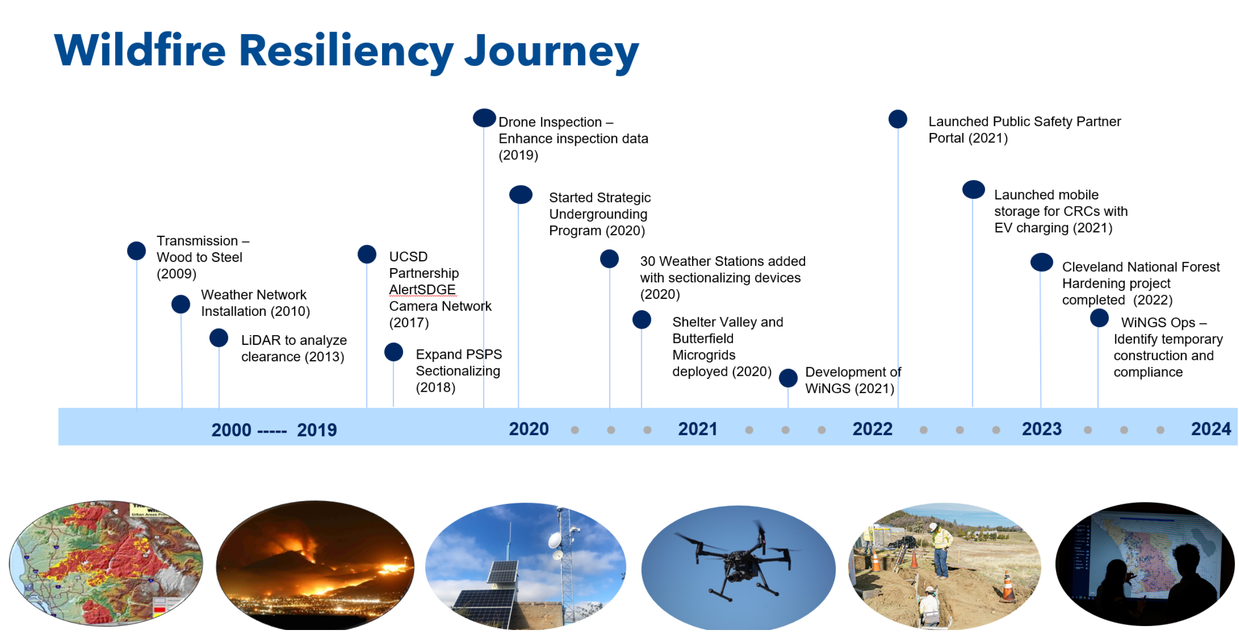


Figure 7 illustrates grid hardening since 2008 and outlines the future grid hardening strategy, showcasing cumulative overhead mileage mitigated through transmission hardening, traditional hardening, covered conductor, and strategic undergrounding.

Figure 7: Wildfire Resiliency Journey



The historical safety work activities completed after the 2003 Cedar Fire and the 2007 Witch Fire using the metrics highlighted in Figure 8 from 2008-2024 include:

- **2009**: Began wood to steel pole hardening on transmission system
- **2010:** Began installation of largest utility-owned weather network, reaching 223 stations
- **2013**: Began using Light Detection and Ranging (LiDAR) to analyze clearance and structural adequacy on the Distribution system
- **2017:** Partnered with University of California San Diego and University of Nevada to build the AlertSDGE Camera Network
- **2018:** Expanded the use of sectionalizing to reduce the impacts of PSPS de-energizations
- **2019:** Initiated a drone inspection program to obtain enhanced inspection data concerning the electric system
- **2020:** Began the Strategic Undergrounding Program
- **2020:** Added 30 weather stations with sectionalizing switches
- **2020:** Deployed Shelter Valley and Butterfield Ranch Microgrids
- **2021:** Began development of Wildfire Next Generation System (WiNGS)

- **2021:** Launched Public Safety Partner Portal
- **2021:** Launched mobile energy storage for Community Resource Centers (CRCs) and Electric Vehicle Charging
- **2022:** Completed Cleveland National Forest (CNF) hardening project
- **2024:** Enhanced WiNGS Ops to identify temporary construction and compliance

The safety work that remains to be done is addressed in the controls/mitigations detailed above in Section IV - 2024-2031 Control and Mitigation Plan.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	**Control/Mitigation Name**	**Compliance Drivers**
C526	Distribution Overhead Detailed Inspections	GO 95, GO 165
C530	Distribution Wood Pole Intrusive Inspections	GO 95, GO 165
C536	Distribution Overhead Patrol Inspections	GO 95, GO 165
C565	Transmission Overhead Detailed Inspections	GO 95, GO 165, FAC-501-WECC
C576	Avian Protection	Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Codes defined by California Department of Fish and Game
C544	Pole Clearing	Pub. Util. Code § 451; Public Resources Code § 4292
C551	Prune and Removal (Clearance)	Pub. Util. Code § 451
C554	Detailed Inspections	G.O. 95, Rule 35; Public Resources Code § 4293; FAC-003-4

ATTACHMENT B

WILDFIRE AND PSPS - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF at Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[80] Appropriate data may include company specific data or industry data supplemented by the judgement of subject matter experts. For a listing of inputs utilized as part of this assessment and a description of the data, refer to SDG&E's 2026-2028 Base WMP.[81]

The table below indicates data sources for the WiNGS-Planning model:

Category	Attributes	Database	Submodel
Weather Data	Weather station location Wind Gust and Direction Temperature Humidity Fire Potential Index (FPI) Red Flag Warning (RFW) High Wind Warning (HWW) Other	Meteorology San Diego Supercomputer UCSD.	Likelihood of a risk event
Risk Event Datasets	SAIDIDAT (Electrical outages) Evidence of Heat Reportable CPUC Ignitions Historical PSPS de-energizations Historical SRP de-energizations	Network Management System (NMS) SAIDIDAT Fire Coordination Database	Likelihood of a risk event
Asset Information	Physical Characteristics Location Electrical Network Configuration	Oracle GIS data	Likelihood of a risk event
Vegetation Database	Tree species and location Association to electrical asset Inspection and maintenance history	Oracle GIS data	Likelihood of a risk event

80 D.24-05-064, RDF Row 10 and Row 29.

81 2026-2028 Base WMP at Section 5 and Appendix B.

Category	Attributes	Database	Submodel
External Sources	Public Land Use Maps Street and Road Network Fuels Layer Ignition Component	CalTrans Database OSMnx (https://github.com/gboeing/osmnx) https://wxmap.sdsc.edu//	Likelihood of a risk event Consequence of a risk event
Wildfire Consequence Simulations	Technosylva 24-h Historical fire weather days Egress factor		Likelihood of a risk event Consequence of a risk event
Customer Information	Customer Segmentation AFN Customer Class Meter Location and associated Transformer	Customer Information Oracle GIS data	Consequence of a risk event
Planned Hardening Work Scope	Existing in-flight planned UG/CC grid hardening work scope scheduled by Engineering, at the span-year granularity	Project Information (Primavera P6 system)	Likelihood of a risk event

ATTACHMENT C

WILDFIRE AND PSPS - SUMMARY OF ELEMENTS OF BOW TIE

ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C501	Wireless Fault Indicators	DT.1-DT.6	PC.4
C502	Capacitor Maintenance and Replacement Program (SCADA)	DT.1, DT.3	PC.1-PC.4
C504	Standby Power Program (Fixed Backup Commercial)	DT.11	PC.8
C506	Microgrids	DT.11	PC.8
C507	CMP Repairs	DT.1, DT.3, DT.7, DT.6	PC.1-PC-4, PC.7, PC 8
C508	Advanced Protection	DT.1-DT.6 DT.9	PC.1-PC.3
C510	Hotline Clamps	DT.1, DT.3	PC.1-PC.4
C512	Customized Resiliency Assessments	DT.11	PC.7 & PC.8
C516	Generator Assistance Program	DT.11	PC.4
C518	Strategic Undergrounding	DT.1-DT.11	PC.1-PC.8
C520	Distribution Overhead System Hardening	DT.1 - DT.5, DT.7	PC.1-PC.5
C522	Transmission Overhead Hardening (Distribution Underbuild)	DT.1, DT.2, DT.3, DT.7	PC.1-PC.3, PC.8
C524	Lightning Arrestor Removal/Replacement Program	DT.1- DT.3	PC.1-PC.4
C526	Distribution Overhead Detailed Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C528	Distribution Infrared Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C530	Distribution Wood Pole Intrusive Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C534	Risk-Informed Drone Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C536	Distribution Overhead Patrol Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C546	Aviation Firefighting Program	DT.7-DT.10	PC.1-PC.7
C548	Wildfire Infrastructure Protection Teams	DT.7-DT.10	PC.1-PC.7

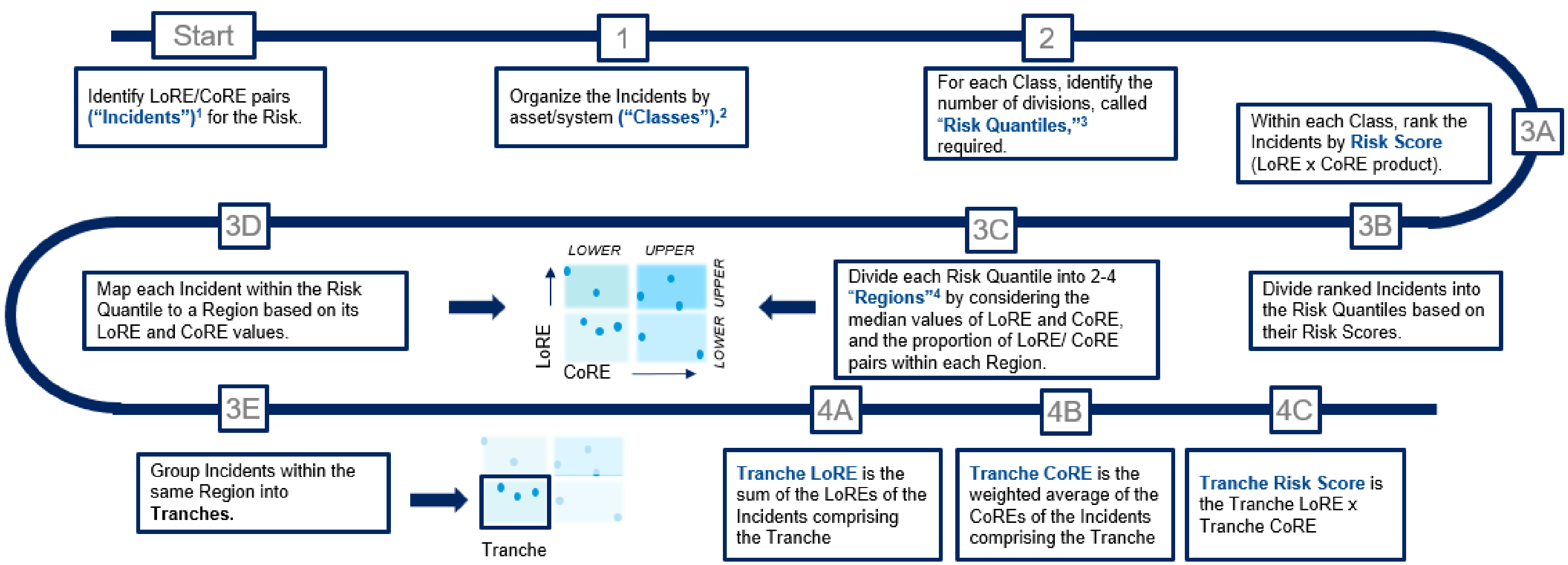
ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C550	Combined Covered Conductor	DT.1-DT.7, DT.10, DT.11	PC.1-PC.8
C552	PSPS Sectionalizing Enhancements	DT.11	PC.7, PC.8
C559	LiDAR Flights	DT.4	PC.4
C564	Distribution Communications Reliability Improvements (DCRI)	DT.1- DT.3	PC.1- PC.4
C565	Transmission Overhead Detailed Inspections	DT.1- DT.3, DT.7, DT.6	PC.1-PC-4, PC.7, PC. 8
C568	Strategic Pole Replacement	DT.1- DT.4, DT.7	PC.1-PC.4
C569	Cleveland National Forest Fire Hardening	N/A- Program Discontinued	
C570	Expulsion Fuse Replacements	DT.1- DT.3	PC.1-PC.4
C573	Early Fault Detection	DT.1- DT.3	PC.1-PC.4
C576	Avian Protection	DT.5	PC.1-PC.4
C537	Off-Cycle Patrol	DT.4	PC.1-PC.6
C540	Fuels Management	DT.4	PC.1-PC.6
C544	Pole Clearing	DT.4	PC.1-PC.6
C551	Prune and Removal (Clearance)	DT.4	PC.1-PC.6
C554	Detailed Inspections	DT.4	PC.1-PC.6
C555	Vegetation Restoration Initiative	N/A- Program Discontinued	
C578	QA/QC of Veg Management	DT.4	PC.1-PC.6
C561	Fire Potential Index	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C562	Weather Station Maintenance and Calibration	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C572	Situational Awareness and Forecasting	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C556	Engagement with AFN Populations	DT.10, DT.11	PC.5, PC.7
C557	Public Outreach and Education Awareness	DT.10, DT.11	PC.5, PC.7
C560	Mylar Balloon Alternatives	N/A- Program Completed	
C567	Public Emergency Communication Strategy	DT.10, DT.11	PC.5, PC.7

ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C571	Emergency Preparedness and Recovery Plan	DT.1, DT.7, DT.10, DT.11	PC.1-PC.3, PC.5-PC.8
C566	Enterprise Data Foundation	DT.1-DT.11	PC.1-PC.8
C575	Vegetation Management Enterprise System	DT.4	PC.1-PC.5
C563	Wildfire Mitigation Strategy Development	DT.1-DT.11	PC.1-PC.8
C558	Risk Methodology and Assessment	DT.1-DT.11	PC.1-PC.8
M503	Grounding Banks	DT.1-DT.6 DT.9	PC.1-PC.3

ATTACHMENT D

APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



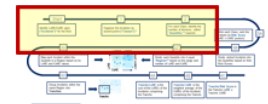
NOTES

1 *For example, **Incidents (or "Risk Incidents")** for Wildfire are simulated risk events at the feeder segment level.*

2 *For example, **Classes (or "Asset Classes")** for Wildfire include Non-HFTD, Tier 2, and Tier 3*

3 ***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

4 *The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*



Start: Identify LoRE/CoRE pairs **("Incidents")**[1] for the Risk.

1: Organize the Incidents by asset/system **("Classes")**.[2]

2: For each Class, identify the number of divisions, called **"Risk Quantiles,"**[3] required.

Class	LORE / CORE PAIRS (Feeder Segments)	TOTAL # Feeder Segments
Non-HFTD	1072-6	1362
	1081-38AE	
	1085-109F	
	…and 1359 more pairs	
Tier 2	215-1534R	472
	351-819R	
	CB 236	
	…and 469 more pairs	
Tier 3	237-30R	308
	524-69R	
	909-451	
	…and 305 more pairs	

Non-HFTD → **10**

Tier 2 → $\min\left(\frac{N}{8} - 1, 9\right) < K \le \min\left(\frac{N}{8}, 10\right)$ → **10**

Tier 3 → **10**

Step 3 for *Non-HFTD*

Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product).

3A

3B

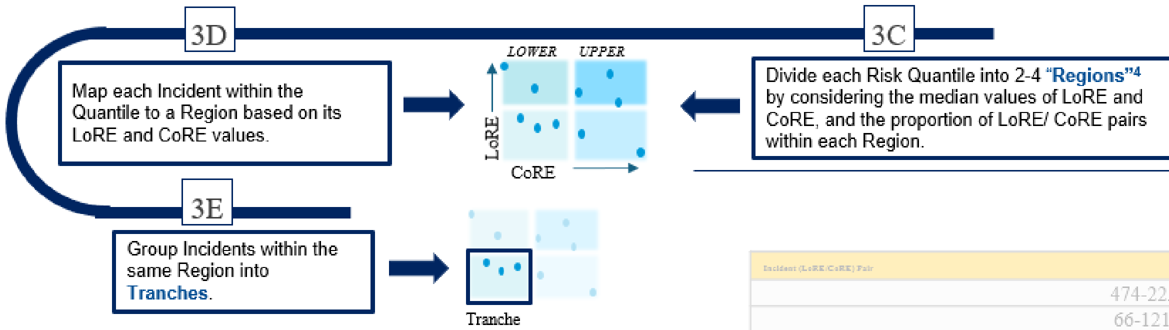
Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.

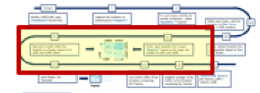
Class	LoRE / CoRE PAIRS (Feeder Segments)	TOTAL # Feeder Segments
Non-HFTD	1072-6	1362
	1081-38AE	
	1085-109F	
	...and 1359 more pairs	

10

From Step 2 for *Non-HFTD*

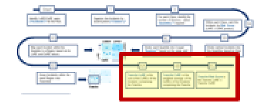
Feeder Segments	Risk Score	Rank (3A)	Risk Quantile (3B)
474-22AE	6,416,471	1	#1
66-1213R	5,294,850	2	
305-32R	4,217,523	3	
CB 471	3,795,870	4	
CB 305	2,776,072	5	
305-35R	2,362,924	6	
307-1684R	2,109,886	7	
206-974	1,937,035	8	
221-1251R	1,803,724	9	
288-18	1,711,403	10	
206-953R	1,580,440	11	
474-29	1,506,093	12	
504-1563	1,419,193	13	
410-50R	1,312,433	14	
CB 412	1,304,299	15	
473-36R	1,299,233	16	
63-797R	1,291,049	17	
241-570	1,262,492	18	
CB 590	1,189,056	19	
...	...	20-1362	...





3A 3B 3C 3D

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Risk Quantile	Region	Tranche
474-22AE	6,416,471	1		LL/UC	NonHFTD-1-1
66-1213R	5,294,850	2		LL/UC	NonHFTD-1-1
305-32R	4,217,523	3		LL/UC	NonHFTD-1-1
CB 471	3,795,870	4		LL/UC	NonHFTD-1-1
CB 305	2,776,072	5		LL/UC	NonHFTD-1-1
305-35R	2,362,924	6		LL/UC	NonHFTD-1-1
307-1684R	2,109,886	7		LL/UC	NonHFTD-1-1
206-974	1,937,035	8		LL/UC	NonHFTD-1-1
221-1251R	1,803,724	9		UL/LC	NonHFTD-1-2
288-18	1,711,403	10	#1	LL/UC	NonHFTD-1-1
206-953R	1,580,440	11		LL/UC	NonHFTD-1-1
474-29	1,506,093	12		LL/UC	NonHFTD-1-1
504-1563	1,419,193	13		LL/UC	NonHFTD-1-1
410-50R	1,312,433	14		LL/UC	NonHFTD-1-1
CB 412	1,304,299	15		LL/UC	NonHFTD-1-1
473-36R	1,299,233	16		LL/UC	NonHFTD-1-1
63-797R	1,291,049	17		LL/UC	NonHFTD-1-1
241-570	1,262,492	18		UL/LC	NonHFTD-1-2
CB 590	1,189,056	19		LL/UC	NonHFTD-1-1
...	...	20-1362	...	...	...



4A — **Tranche LoRE** is the sum of the LoREs of the Incidents comprising the Tranche

4B — **Tranche CoRE** is the weighted average of the CoREs of the Incidents comprising the Tranche

4C — **Tranche Risk Score** is the Tranche LoRE x Tranche CoRE

Incident (LoRE/CoRE) Pair (Feeder Segment)	Tranche	4A Tranche LoRE	4B Tranche CoRE	4C Tranche Risk Score
474-22AE	NonHFTD-1-1	2.20	29,821,762	65,746,868
66-1213R	NonHFTD-1-1			
305-32R	NonHFTD-1-1			
CB 471	NonHFTD-1-1			
CB 305	NonHFTD-1-1			
305-35R	NonHFTD-1-1			
307-1684R	NonHFTD-1-1			
206-974	NonHFTD-1-1			
288-18	NonHFTD-1-1			
206-953R	NonHFTD-1-1			
474-29	NonHFTD-1-1			
504-1563	NonHFTD-1-1			
410-50R	NonHFTD-1-1			
CB 412	NonHFTD-1-1			
473-36R	NonHFTD-1-1			
63-797R	NonHFTD-1-1			
CB 590	NonHFTD-1-1			
221-1251R	NonHFTD-1-2	4.84	5,119,761	24,782,191
241-570	NonHFTD-1-2			
…	…	…	…	…

ATTACHMENT E

WINGS-PLANNING ASSUMPTIONS AND LIMITATIONS

Assumption	**Description**	**Limitation**
Average duration of PSPS de-energization for every SCADA Sectionalizing Device	Historical average PSPS de-energization in the service territory, along with subject matter expertise, is used to determine this value.	Estimating the potential duration of a PSPS de-energization at each SCADA Sectionalizing Device is a complex task as multiple variables are in play (e.g., weather forecast, firefighting resources, existing wildfires, crew availability).
Customer impact scaling factor (Wildfire, PSPS, PEDS Vulnerability)	Subject matter expertise is used to determine a scaling factor to more accurately represent PSPS impacts to the critical and vulnerable population.	There is a lack of reliable data on how to quantify PSPS impacts on customers, specifically to subsets of customers such as critical and vulnerable.
Serious injuries and fatalities (SIFs) per customer minute de-energized	Historical data and subject matter expertise is used to estimate the potential number of fatalities and serious injuries due to a PSPS de-energization.	There is a lack of historical data on serious injuries or fatalities due to PSPS de-energizations in California.
Financial impact during a PSPS de-energization	Subject matter expertise is used to estimate this value based on proxies derived from the federal per diem rate for lodging, meals, and incidentals in San Diego County.	There is a lack of historical data on the financial impacts to SDG&E customers due to PSPS de-energizations.
Number of SIFs per structure destroyed in case of a wildfire	Subject matter expertise is used to estimate this value based on worst-case estimations of acres burned calculated by Technosylva.	This metric is highly dependent on the availability and effectiveness of firefighting resources, the timeliness and clarity of evacuation notices, the specific location of the event, and the prevailing weather conditions.
Outage duration in case of a wildfire	Subject matter expertise is used to estimate this value based on estimates of outage duration and assumed restoration duration.	Estimating restoration time following a catastrophic wildfire is inherently challenging due to the numerous variables involved. The severity of the event plays a crucial role, as more severe wildfires can cause extensive damage to infrastructure, making restoration efforts more complex and time-consuming. Additionally, factors such as the availability of resources, accessibility of affected areas, weather conditions, and the extent of damage to

Assumption	Description	Limitation
		critical infrastructure all contribute to the difficulty in providing accurate restoration time estimates.
Financial impacts in case of a wildfire	Subject matter expertise is used to estimate this value based on simulation outputs of buildings destroyed and acres impacted output.	Property value estimates are based on general assumptions and do not take into account the size, condition, location, or market value of the property.
Annual risk event rates	Historic data is used to normalize wildfire, PSPS, and PEDS risks and quantify expected value averages.	Annual frequency rates do not account for potential future conditions or changes. This means that while the model provides a reliable estimate based on historical data, it may not fully capture the impact of evolving factors such as climate change, new infrastructure developments, or changes in vegetation and land use.
Burn probability	Subject matter experts select these days to balance a representative sample of days with fire weather conditions present in the HFTD. This approach aims to accurately estimate the potential impacts of catastrophic wildfires while considering current weather conditions, community insights, and local knowledge (e.g., terrain, fuels, vegetation). Additionally, it takes into account computational resources, given the time and cost involved in conducting this analysis.	. Subject matter expertise is used to select a representation of the worst fire weather days in the service territory. For the days selected of the worst fire weather days in the service territory, the burn probability is assumed to be 100%.
Wildfire hazard intensity	Data from the 125 worst fire weather days identified by subject matter experts is used by Technosylva to calculate this value. Simulated outputs include flame length, rate of spread, acres burned, buildings	Technosylva's unsuppressed simulations have a duration of 24 hours. Wildfire Consequence values are calculated based on acres burned and structures destroyed.

Assumption	Description	Limitation
	threatened, buildings destroyed, and population impacted.	
PEDS annual frequency	This value is determined using historical data on PEDS outage durations in HFTD portions of the service territory.	This annual frequency may not accurately represent future outage frequencies, as the number of future device installations and outages are unknown and difficult to estimate. SDG&E activates settings only during extreme or elevated fire weather conditions.
PEDS de-energization Consequence values	This value is determined using historical data on PEDS outage durations recorded in the SAIDIDAT database.	Historical duration and CMI estimates may not accurately reflect future PEDS Consequence impact estimates.
Annual PSPS de-energization during high fire risk days	This value is determined using subject matter expertise and historical event records.	The current methodology is calibrated using past PSPS de-energizations and may not adequately account for the increasing frequency and severity of fire weather conditions.
Overhead-to-underground mile conversion rate	This contingency value is applied to non-roadway miles to account for additional miles to underground.	A 20% factor is included to capture the OH to UG conversion factor in the financial model. This value is estimated based on historical data.
Mitigation installation cost-per-mile	Historical grid-hardening data and subject matter expertise are used to determine this value.	This assumption does not take into account site specific attributes.
Mitigation efficacy rates	Data on efficacy studies for each mitigation option is used to determine this value.	Limited to available internal risk event data and subject matter estimates of risk reduction.
Hardening-State Station Alert Speed Thresholds	Operational wind gust thresholds determined during the latest PSPS are used to determine this value.	Qualitative factors taken into account during PSPS de-energization are not accounted for that may alter alert speed thresholds.

ATTACHMENT F
STRATEGIC UNDERGROUNDING AND COMBINED COVERED CONDUCTOR MITIGATION EFFECTIVENESS

Mitigation effectiveness is calculated using a comprehensive methodology that combines field data, benchmarking, collaboration with other IOUs, and subject matter expertise. Field data involves analyzing historical outage data, failure modes, location, grid configuration, and CPUC Reportable and Non-Reportable Ignitions. Due to the relatively low number of incidents, subject matter expertise is utilized to assess potential risk reduction and reliability improvements. This multi-faceted approach provides a thorough evaluation of mitigation effectiveness, providing an estimation of mitigation's impact on wildfire risk to guide decisions on long-term hardening strategies.

Tables F-1 and F-2 detail the calculation of the effectiveness of strategic undergrounding and covered conductor as wildfire mitigation measures across various risk drivers.

Table F-1: Strategic Undergrounding Mitigation Effectiveness

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
Equipment	Conductor Failure	68	100%	68	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	OH Equipment (Non Conductor)	348	100%	348	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	UG Fuse Failure	1	95%	0.95	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Transformer Failure	2	95%	1.9	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	Switch Failure (UG, sub surface)	1	95%	0.95	SDG&E has not experienced any reportable ignitions in the 2019-2024 period for this ignition driver, therefore, "1" was used for the total number of ignitions to account for the possibility of an asset-related ignition.
Equipment	Equip Failure (Tee Connector)	5	95%	4.75	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Cable Failure	18	95%	17.1	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Connection	4	95%	3.8	The enclosed nature of underground structures is assumed to help contain any ignition, preventing

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
	Device Failure				spread to surrounding areas.
External	Vehicle Contact (Pole)	16	100%	16	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Vehicle Contact (Surface Structure)	5	95%	4.75	Although vehicle contacts can occur on surface structures associated with UG segments, there are significantly fewer overall surface structures (no poles, no wires, and no associated equipment).
Equipment	OH Equipment Failure Unknown	20	100%	20	Ignitions with no information in Primary or Secondary Cause. (unknown) With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	OH to UG connection	10	95%	9.5	The transition from OH to UG is done via a pole with cable going up the pole. Compared to bare wire on an overhead system, a transition pole has less ignition risk due to the wire being an underground cable, which is insulated.
External	All Other OH	174	99%	172.26	This category accounts for potential factors in the overhead system that could impact underground equipment (e.g., contamination and non-utility fires). The effectiveness rate is higher than the OH to UG connection rate because it is assumed that the enclosed nature of underground structures offers better protection and containment of potential ignitions, preventing them from spreading to surrounding areas.

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
External	Other OH Contact	45	100%	45	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Other UG Contact	4	75%	3	The effectiveness rate accounts for potential ignitions caused by dig-ins near underground structures. This assumption is based on the understanding that the enclosed nature of underground structures helps contain any ignition, preventing spread to surrounding areas.
External	Vegetation Contact	58	95%	55.1	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas. The effectiveness rate accounts for potential vegetation contacts such as roots growing and encroaching on underground structures.
External	Balloon Contact	22	100%	22	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Animal Contact (OH)	25	100%	25	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Animal Contact (UG)	1	80%	0.8	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas. 80% effectiveness is assumed to account for potential contact in the underground assets.
	Total	**827**		**818.86**	

To calculate the effectiveness of strategic undergrounding, the total number of ignitions estimated to be reduced by strategic undergrounding is divided by the total for the number of distribution ignitions, as shown in the following equation:

$$\text{SUG Mitigation Effectiveness} = \frac{Ignitions\ Reduced}{Total\ Ignitions} = \frac{818.86}{827} = 99.02\%$$

Therefore, the effectiveness of strategic undergrounding due to mitigations that were completed from 2019-2024 is 99.02%.

Table F-2: Covered Conductor Mitigation Effectiveness

Distribution Risk Driver	CPUC Reportable and Non-Reportable Ignitions							Avg. Risk Events per Year	2024/2025 SME Risk Reduction (%)	Estimated Ignitions reduced by CCC
	2019	2020	2021	2022	2023	2024	Total			
Animal Contact	4	6	1	1	2	1	15	2.50	90%	2.25
Balloon Contact	2	6	6	5	1	2	22	3.67	90%	3.30
Vehicle Contact	4	6	2	1	1	2	16	2.67	90%	2.40
Vegetation Contact	12	18	7	4	5	12	58	9.67	90%	8.70
Other contact[a]	3	7	6	12	4	13	45	7.50	50%	3.75
Conductor	9	12	10	10	13	14	68	11.33	90%	10.20
Equipment-Non conductor[b]	81	65	49	52	59	42	348	58.00	39%	22.62
Other All[c]	42	31	27	27	20	27	174	29.00	10%	2.90
Undetermined[d]	4	6	5	2	1	2	20	3.33	70%	2.33
Total	**161**	**157**	**113**	**114**	**106**	**115**	**766**	**127.67**	**---**	**58.45**

a. Other contacts include external contacts caused by SDG&E or non-SDG&E personnel, customers, and foreign objects (excluding animals, balloons, vegetation, and vehicles) in overhead electrical equipment.
b. Equipment-Non conductor includes electrical equipment like lightning arrestors, fuses, and transformers.
c. Other All includes contamination, dig-ins, vandalism, and non-utility fires.
d. Undetermined includes outages/Ignitions with no information in Primary or Secondary Cause.

To calculate the effectiveness of Covered Conductor, the total number of ignitions estimated to be reduced by Covered Conductor is divided by the average number of risk events per year, as shown in the following equation:

$$Covered\ Conductor\ Mitigation\ Effectiveness = \frac{58.45}{127.67} \times 100 = 45.8\%$$

To determine the overall effectiveness of Combined Covered Conductor mitigation, the effectiveness of the Covered Conductor (45.8%) is combined with the impact of Falling Conductor Protection (FCP) and Early Fault Detection (EFD) mitigations. The mitigation effectiveness of FCP on all system outages is estimated at 8% using a similar methodology as the Covered Conductor, while EFD's effectiveness is estimated at 16%, based on asset location, installation, and historical risk event data.

$$Combined\ Effectiveness = 1 - [(1 - CC\ Efficacy) \times (1 - FCP\ Efficacy) \times (1 - EFD\ Efficacy)]$$
$$Combined\ Effectiveness = 1 - [(1 - 0.458) \times (1 - 0.08) \times (1 - 0.16)] = 58.1\%$$

The mitigation effectiveness for Combined Covered Conductor is therefore calculated to be 58.0%. Reference Section 6.1.3.3.5 Measuring Effectiveness of Mitigation Initiatives[82] and SDGE-25U-04 Continuation of Grid Hardening Joint Studies in 2026-2028 Base WMP.[83]

SDG&E will continue to review these mitigation effectiveness analyses based on reportable and non-reportable ignitions for Combined Covered conductor, Strategic Undergrounding, and combined mitigation effectiveness.

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82 2026-2028 Base WMP at 104.

83 2026-2028 Base WMP, Appendix D at 30.